DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

Ships and Still More Ships has become the crying need of the democracies. Freighters, tankers, and cargo vessels are required in great numbers to meet the toll of Axis marauders, as well as large numbers of naval vessels for making our Two-Ocean Navy a reality. November MACHINERY will present articles from outstanding privately operated shipyards and the world's largest Navy Yard, showing how the use of modern machine tools, metal-working machinery, and welding equipment is enabling our high-set goals to be attained.

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Number 2

OCTOBER, 1941

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—and in the evening, by lantern or moonlight, men, women, and children tediously picked the seeds from the cotton.

MACHINERY

Volume 48 NEW YORK, OCTOBER, 1941 Number 2

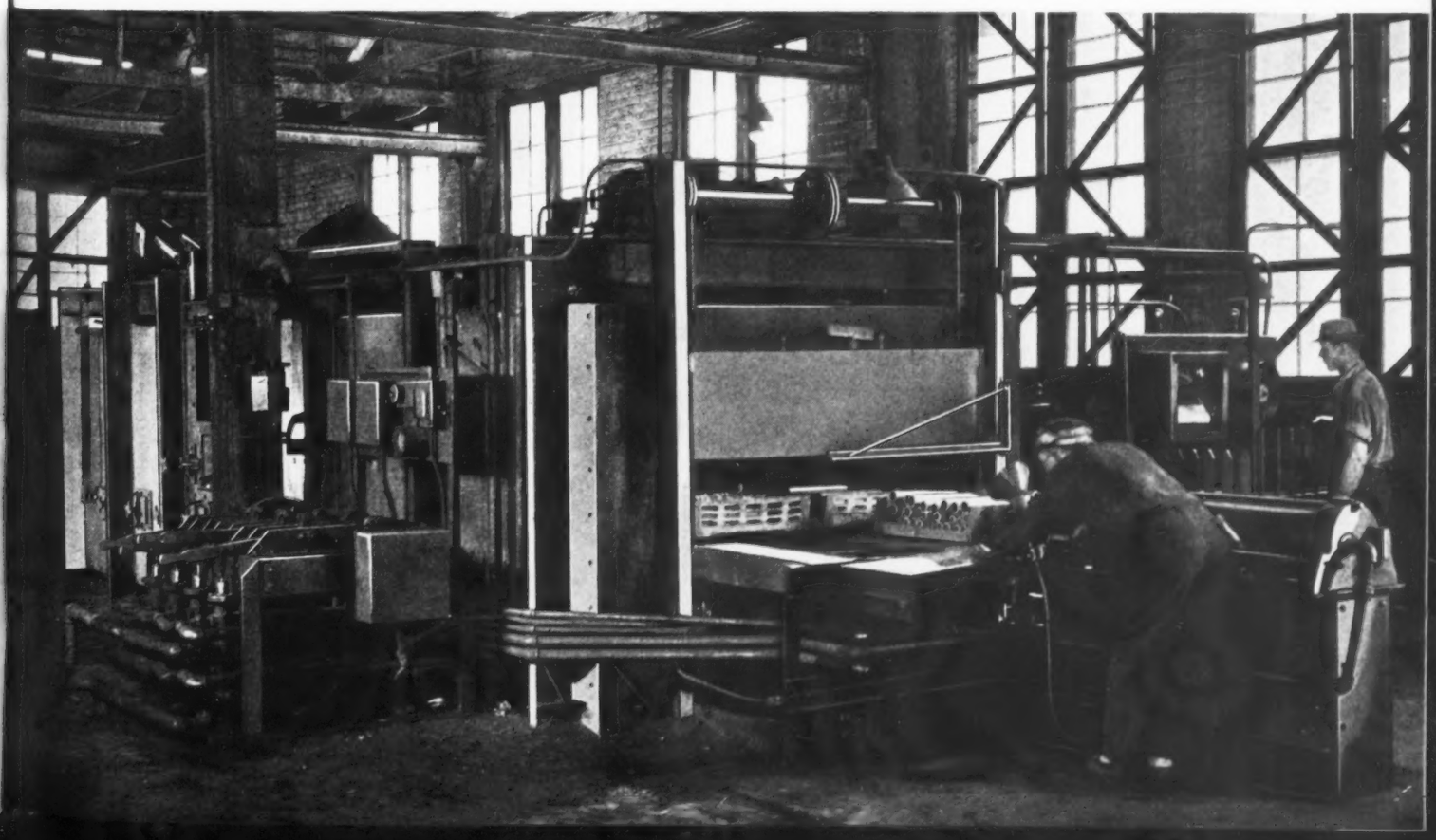
Heat-Treating Parts for Deep Oil-Well Pumps

Heat-Treating Methods Used in the Pacific Coast Plant of the Axelson Mfg. Co. to Make Deep-Well Plunger Pump Parts Capable of Withstanding Severe Service in Oil Fields

By CHARLES O. HERB

PUMPS used at oil-wells to bring crude oil, with its sediment of earth, gravel, and rock, to the surface must be built to withstand severe service. The pump valve-seats, for example, must continuously withstand pressures up to 3000 pounds per square inch while, at the same time, being subjected to a severe pounding action. This pounding is due to the fact that the full force of the column of oil extending from the bottom of the well to the surface of the ground—a distance of 5000 feet or more—is directed against the ball that registers on the valve-seat.

Manufacture of pump parts from high-grade materials, proper hardening, and accurate machining of all working members are the solution to this problem. The methods employed in the Los Angeles, Calif., plant of the Axelson Mfg. Co. in making pump parts to extremely close tolerances were described in articles published in the December, 1940, and February, 1941, numbers of MACHINERY. This article will describe some of the heat-treating practices followed in that plant to obtain the desired degree of hardness, as well as uniformity of hardness, in the pump parts.



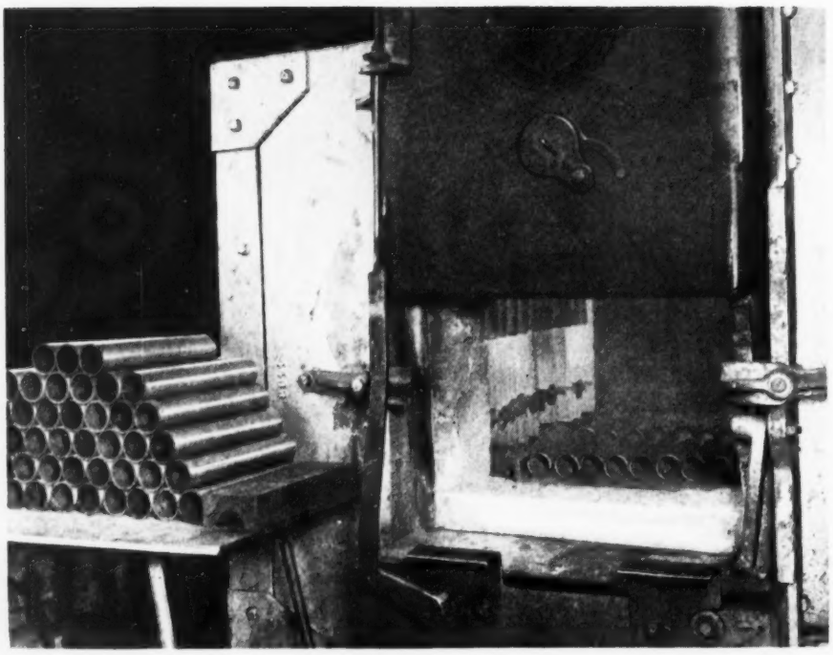


Fig. 1. Electric Furnace Used to Heat the Cast-iron Liners for the Hardening Process after the Liners have been Rough-machined

Before any machining operations are performed on the liners, the castings are relieved of all stresses in a normalizing operation performed in the large electric furnace shown in the heading illustration. The hydraulic pusher seen at the front of the furnace pushes loaded trays of work periodically toward the rear end in a row extending along the right-hand side. This device is operated every half hour and pushes each tray of work slightly more than the length of the tray.

There is a similar hydraulic pusher on the right-hand side of the furnace near the rear end for pushing the trays of work from the right-hand row to a left-hand row, and a third hydraulic pusher at the back of the furnace for pushing the trays forward to the front end along the left-hand row. In the operation sequence, the pusher at the back is actuated first to push the trays forward a distance slightly more than the length of one tray, thus leaving an empty space at the back end of the left-hand row and pushing one tray out of the furnace at the front end. Then the pusher on the right-hand side of the furnace near the rear end operates to push the last tray in the right-hand row across the furnace into the left-hand row. The pusher at the front finally charges a new tray of work into the furnace and advances all the others in the right-hand row, filling the space that became empty with the operation of the second plunger.

There are twelve trays of work in the furnace at all times, each tray remaining in the furnace for approximately six and one-half hours. The furnace door is closed after each discharge of a tray and the entry of a new batch of work.

The heating elements are installed in the back half of the furnace only. With this arrangement, the incoming trays of work are preheated by the heat thrown off from the outgoing trays. The tem-

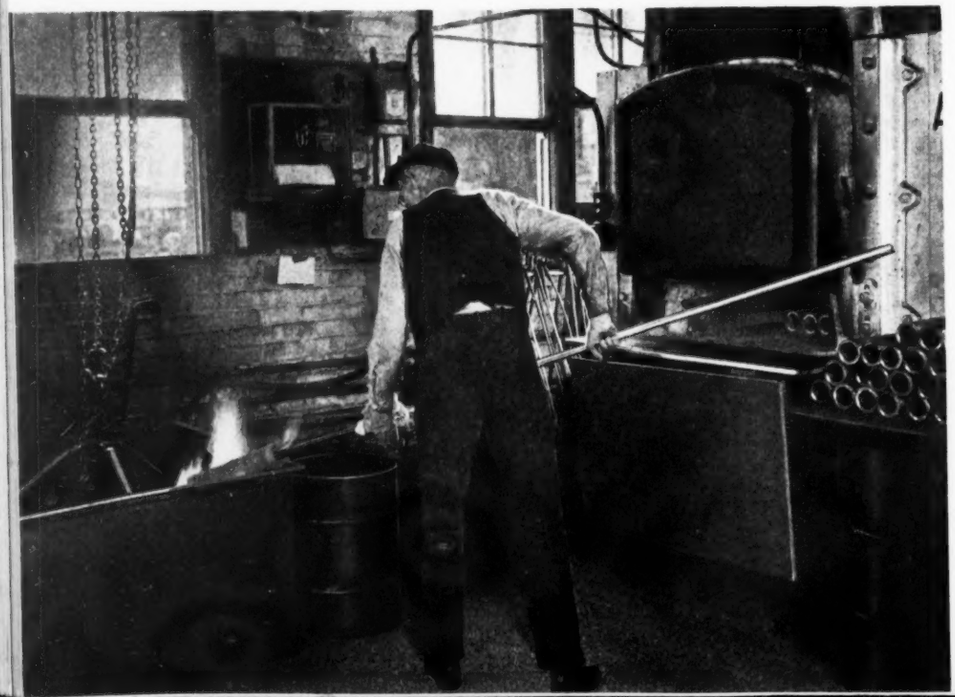


Fig. 2. Dropping Liners, Two at a Time, into the Quenching Tank after They have been Heated to the Required Temperature

perature of the furnace is maintained at 1000 degrees F. under the control of Leeds & Northrup recording pyrometers.

In addition to relieving strains in the cast-iron liners, this normalizing process increases their strength and toughness. The elimination of strains minimizes distortion in the hardening operation which is performed after rough-machining cuts have been taken on hardened types of liners. Hardened liners are cast from an alloy containing nickel, chromium, and molybdenum. The hardening operation is performed primarily to obtain maximum strength and a high degree of wear resistance.

The liner hardening operation is performed in the electric furnace shown in Fig. 1, with the liners laid out on the furnace hearth. When the furnace door is closed on a batch of work, the temperature is usually between 1200 and 1300 degrees F. The loaded furnace is heated to 1600 degrees F., which requires from one to two hours, and the work is held at that temperature from fifteen to thirty minutes, depending upon the wall thickness of the liners.

The liners are then quenched in oil, being dropped into a quench tank, two at a time, from the gripping end of a long pair of tongs, as shown in Fig. 2. The quenching oil is constantly circulated through Braun heat exchangers which hold its temperature down to less than 140 degrees F. In these devices, the oil runs through tubes which are surrounded by cold water. The oil is pumped from the quench tank to the exchangers and back to the tank. The parts are left in the quench until their temperature has been reduced to 100 degrees F. When completely cooled, the liners have a hardness of from 53 to 56 Rockwell C.

The liners are next thoroughly washed in a solution of Turco. For this operation, they are stacked in a tank in such a manner that sprays of the solution can be directed against all inside and outside surfaces, so as to clean them completely of oil. If any oil were left on the liners, a gas would be generated in the tempering furnace that might create a hazardous condition.

In this hardened condition, the liners are relatively brittle and do not possess the required strength. For this reason, they are tempered in the Homo electric furnace illustrated in Fig. 3. The temperature is raised to 800 degrees F. for the tempering operation, and the parts are held at that temperature for approximately two hours. Air is circulated constantly through the load of work by a fan. An auxiliary fan discharges all smoke from the operation to the outside of the building. This considerably reduces the smoke in the heat-treating department and adds to the comfort of the workmen. The fan can be seen on the right-hand side of the furnace in the illustration.

Upon cooling after the tempering operation, the liners have a hardness of between 40 and 45 Rockwell C, and this degree of hardness extends com-

Fig. 3. Homo Electric Furnace Filled with Hardened Liners Ready for Tempering

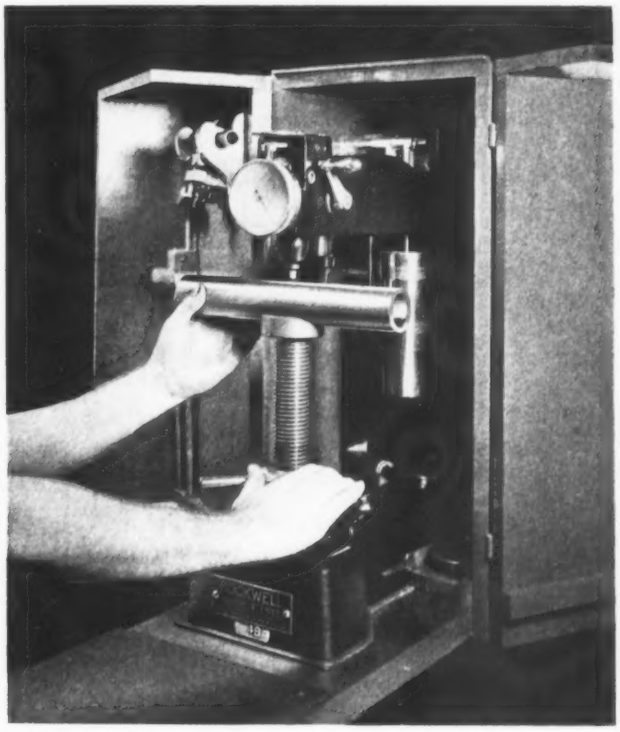


Fig. 4. Each Liner is Tested for Hardness after being Hardened and Tempered

pletely through the liner walls. The liners are approximately twice as hard as in the cast condition and, in addition, their strength and toughness have been developed to the highest degree.

While only one layer of liners is placed on the hearth of the hardening furnace at a time, the tempering basket is completely filled. This basket is lifted out of the furnace to facilitate unloading. Liners ranging from 1 1/16 to 5 3/4 inches inside diameter are hardened, the majority being 1 3/4 and 2 1/4 inches inside diameter. Distortion is not much of a problem, because the wall thickness is never less than 3/16 inch. The liners are 12 inches long. The furnaces used in hardening and tempering the liners are also controlled by Leeds & Northrup recording pyrometers.

The hardness of the liners is checked after the hardening and tempering operations on Rockwell hardness testers. A typical inspection is shown in Fig. 4.

Procedure in Heat-Treating Parts Made from Seamless-Steel Tubing

The seamless-steel tubing liners, also made by the concern, are normalized after rough-machining. Subsequent to normalizing, the liners are finish-machined. They are then carburized, casehardened, and tempered by methods similar to those which will be described later in this article. The liners are finished by grinding.

Super-Service plungers are made from S A E 4615 seamless-steel tubing in outside diameters ranging from 1 1/16 to 5 3/4 inches and in lengths from 33 to 77 inches. These plungers are casehardened on the outside to give them the necessary properties for satisfactory service. They are carburized before any machining is done by packing them, several at a time, in a long tube made of centrifugally cast heat-resisting steel, 7 inches in diameter.

Fig. 5 shows one of these tubes being loaded for the carburizing process, which is carried out in the gas furnace seen in the background. Carburizing compound is packed to a thickness of about 1 inch all around each plunger, the ends of the plunger being first sealed to exclude the carburizer from the inside. The carburizer is made from peach pits and a suitable energizer.

For the carburizing operation, the furnace is brought to a temperature of 1700 degrees F., and the work is held at that temperature for ten hours. The containers of work are then permitted to cool in the furnace, the temperature being allowed to drop at the rate of about 150 degrees F. per hour. After removal of the plungers from the containers, sample pieces are sent to the laboratory for an analysis of their physical properties.

The plungers are next sent to the machine shop, where they are first straightened and then bored in both ends ready for cutting the thread. The ends are also faced. These cuts go beyond the depth of carbon penetration, so that the surfaces on which the cuts are taken will not be affected in the casehardening operation and will be machinable after the heat-treating. Grooves are also cut externally around the tube at intervals of about 3 inches to a depth below the carburization. Thus any straightening necessary after hardening can be performed without bending the hardened surfaces. When the plungers are placed in service, the grooves act as fluid seals and prevent the leakage of oil between plungers and liners.

The plungers are then returned to the heat-treating department, where they are heated to 1450 degrees F., held at that temperature for a period of one hour to insure thorough soaking, and then quenched in oil. Stresses set up in the plungers by the quench are removed by tempering, which is performed in the unusual type of electric furnace illustrated in Fig. 6. This furnace is constructed with a series of racks or drawers on which the plungers are laid in rows. They are brought to a temperature of 350 degrees F., and held at that temperature for two hours, after which they are allowed to cool in air. At the end of the heat-

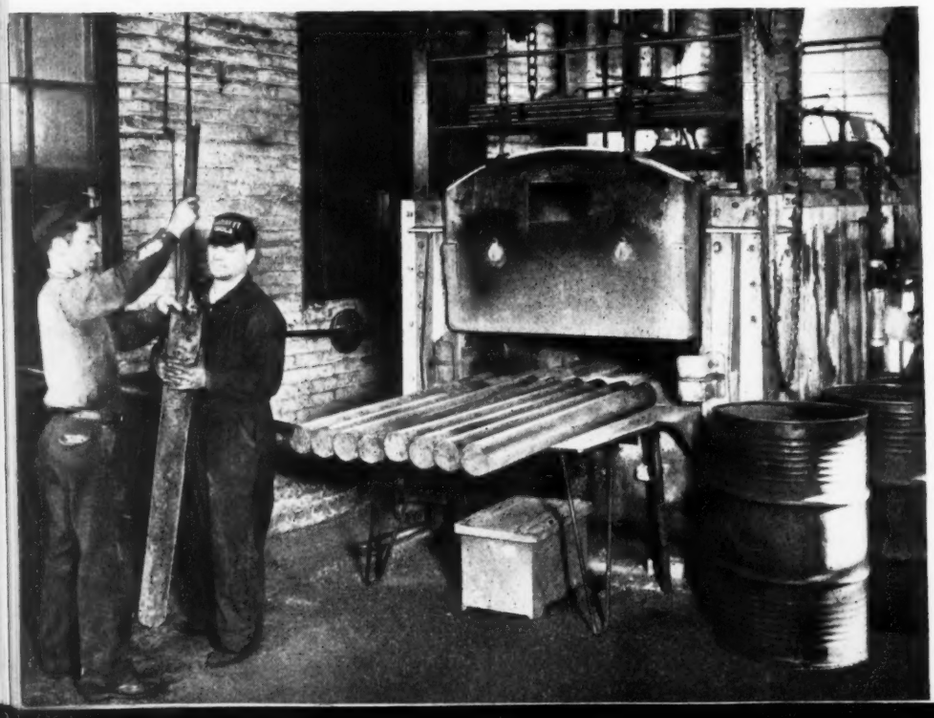


Fig. 5. Loading Plungers into Centrifugally Cast Containers and Packing Them with Carburizer Ready for Carburizing Process

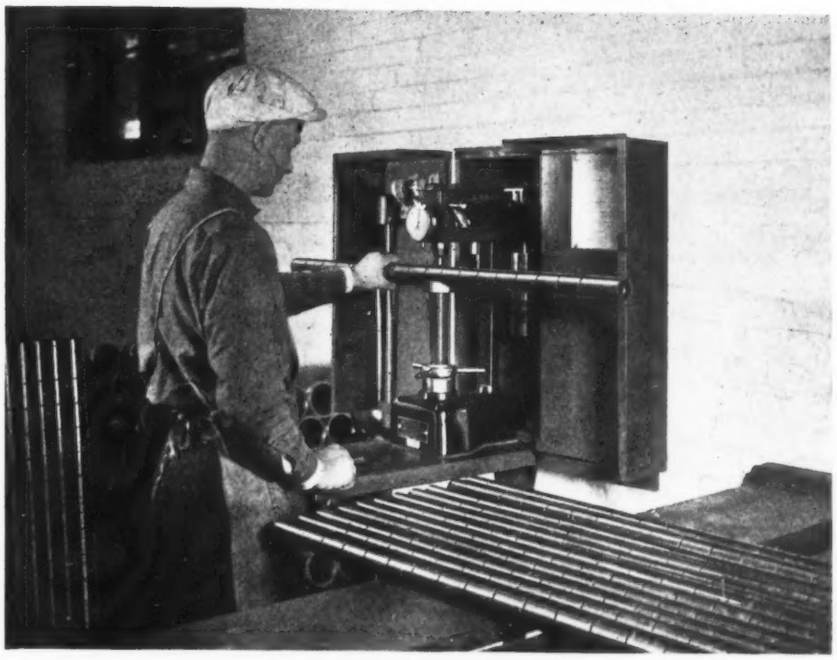


Fig. 7. Testing a Heat-treated Plunger for Hardness; Grooves are Cut below the Depth of Carbon Penetration to Enable the Plungers to be Straightened without Harm to Casehardened Surfaces

treatment, the plungers must have a hardness of between 60 and 65 Rockwell C, as determined on the Rockwell hardness tester illustrated in Fig. 7.

Heat-Treating Valve-Seats

Valve-seats for Axelson pumps are produced by multiple-spindle automatics from bars of stainless steel having either a high content of chromium and carbon or a high chromium, medium nickel, and low carbon content. Each bar of steel used for making the valve-seats is tested in four ways: First, by hot acid in order to check the soundness of the steel; second, by means of a chemical analysis to determine whether the composition is in accordance with specifications; third, by heat-treating to ascertain whether the desired hardness, toughness, and resistance to corrosion can be obtained; and fourth, magnetically after machining and before being placed in stock.

After the seats come from the multiple-spindle automatics, they are heated in the electric furnace shown in Fig. 8 to a temperature between 1775 and 1875 degrees F. The exact temperature depends upon the analysis of the steel, the practice being to heat the seats above the transformation point where the carbon passes from the combined state into the dissolved state, so that the highest possible degree of hardness will be obtained when quenching takes place. The seats are held at the prescribed temperature for a period of one-half to one hour and then quenched in oil. The hardness is then between 40 and 60 Rockwell C, depending on the type of stainless steel used.

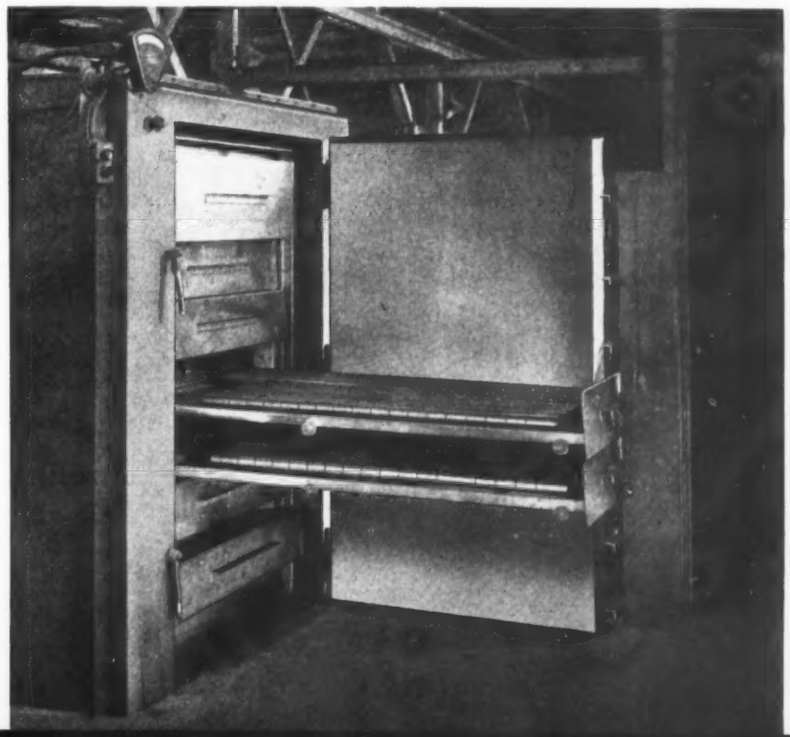


Fig. 6. Electric Furnace Having Racks or Drawers that Enable Large Quantities of Plungers to be Tempered at One Time

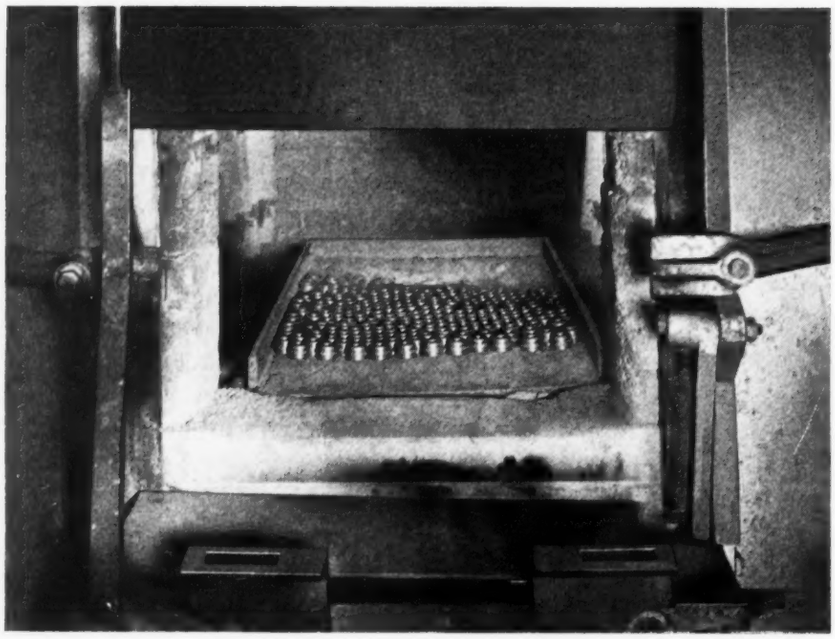


Fig. 8. Valve-seats are Hardened by Heating in This Automatically Controlled Electric Furnace and Then Quenching Them in Oil

After being hardened, the seats are placed in the Homo electric tempering furnace shown in Fig. 9 for relieving the quench strains and increasing the toughness. The tempering temperature ranges from 350 to 700 degrees F., and the length of the process is from two to three hours. The seats are cooled in air.

With the valve-seats are used either stainless steel balls, purchased already ground, or "drops" with flat seats which are manufactured in the Axelson plant from the same material as the valve-seats. These drops are subjected to the same hardening and tempering processes as the valve-seats.

Sucker-rod couplings must be exceptionally strong and tough to withstand the high shock loads, vibration, and stresses encountered in service, and they must have a hardened outside surface that will effectively resist the abrasion that occurs as the coupling rubs against the well tubing during the pumping of oil. For this reason, Axelson sucker-rod couplings are made from a low-carbon steel that is alloyed with nickel and molybdenum, and given a suitable heat-treatment. Automatically operated saws cut the bar stock to lengths approximately 5/16 inch longer than the finished coupling, so as to allow sufficient material for cutting off the carburized ends before the case-hardening operation and thus insure that the ends will be left soft.

Carburizing is performed after the cut-off pieces have been stamped with the trademark, date, size, and number of part. For the carburizing process,

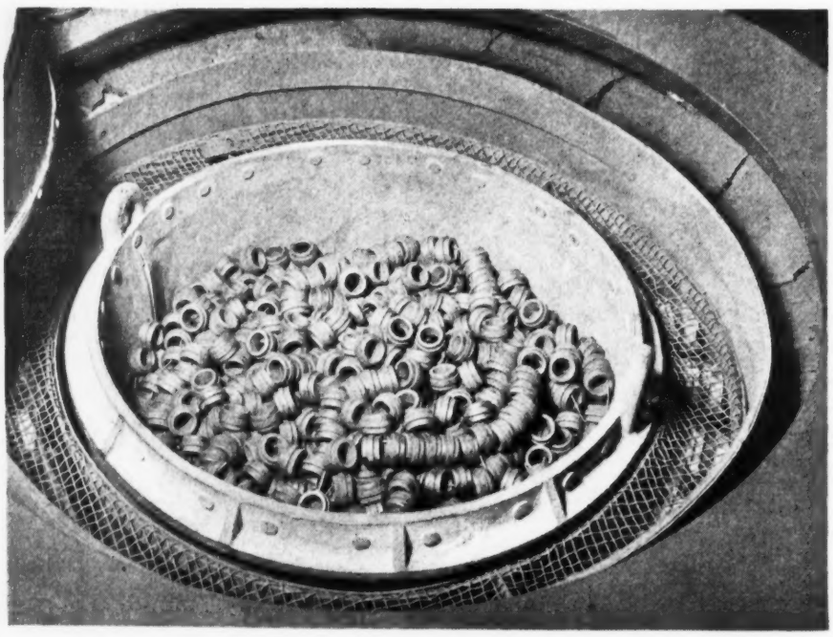


Fig. 9. The Tempering Operation on the Valve-seats is Performed in Another Homo Electric Furnace. Air is Constantly Circulated through the Work during the Process

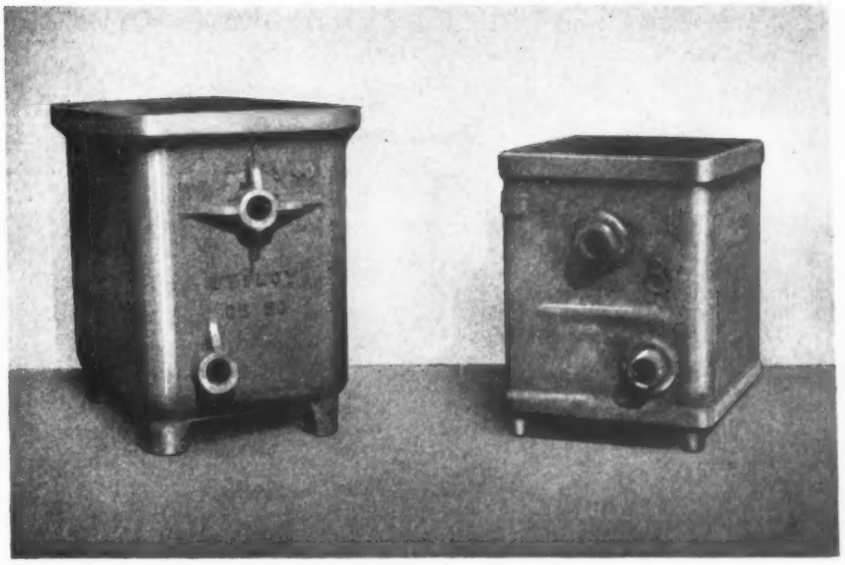


Fig. 10. Carburizing Boxes of Cast and Welded Types Designed for Convenient Handling by Cranes and Easy Unloading

the parts are packed in carbonaceous material in heat-resisting steel boxes of the design shown in Fig. 10, which are provided with a trunnion bearing near the top center of each side to enable them to be easily lifted by a hoist. A blind hole is provided in a lower corner of each side for inserting a hook by means of which the box can be readily dumped. These boxes are either cast of Utiloy heat-resisting steel, as seen at the left, or constructed from Inconel sheets welded together, as shown at the right.

After the boxes have been packed with work and carburizing material, they are placed in a large gas-fired furnace, which is held at a constant temperature of 1700 degrees F. by electric controlling and recording instruments. The boxes are kept at this temperature until the carbon has penetrated approximately 1/16 inch into all exposed surfaces of the steel pieces, the period of time varying with the load. The work is then permitted to cool slowly in the furnace, so that the carburized case remains unhardened. This enables the couplings to be machined.

Samples taken from each box of carburized couplings are sent to the laboratory, where they are cut in half and etched in acid to determine the depth of penetration. The carburizing process increases the carbon content from approximately

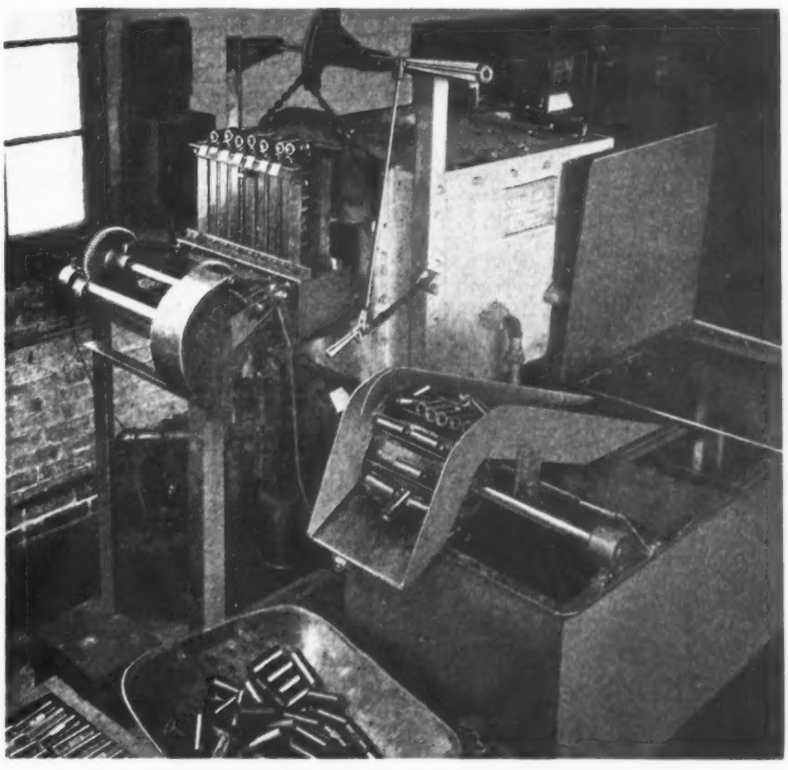


Fig. 11. Hopper-loaded Furnace Used in Hardening Sucker-rod Couplings. The Work is Automatically Dropped into the Quench Tank and Discharged by Conveyor

0.15 per cent to around 1.2 per cent. If the carbon penetration is correct, as determined from the laboratory analysis, the couplings are sent to the machine shop.

After the couplings have been rough-machined, they are returned to the heat-treating department and placed in the seven-row hopper seen at the loading end of the gas-fired furnace in Fig. 11. This furnace is equipped with a pusher that intermittently feeds the couplings in seven rows through the furnace. The work is heated uniformly to a temperature of 1480 degrees F. and held at that temperature for from thirty to forty-five minutes, depending upon the size. The couplings drop out of this furnace at the back into a trough from which they slide into the oil quenching tank seen at the right. The oil in this tank is circulated through a heat exchanger, which keeps it at a predetermined temperature. The couplings are automatically removed from the oil bath by the conveyor seen in the illustration, after which they are placed in a Homo electric furnace and slowly heated to a low temperature, allowed to soak at that temperature for several hours, and then permitted to cool in air. Numerous samples of the couplings from each heat are sent to the laboratory to be checked for hardness.

Flame-Hardening Steel Tubing

External flame-hardening is being practiced in this plant on tubes of S A E 1045 steel by employing a torch which directs a series of gas flames in a circle around the outside of the tubing. Jets of water are also directed on the work in combination with the flames, so that the work becomes hardened without the formation of scale. The gas flames are spaced only 1/8 inch apart. After the flame-hardening operation, the tubes are tempered at a temperature of 350 degrees F.

A Radical Departure in Automobile Bearing Finish

NEWS comes from Detroit relating to a most unusual development in automobile-building practice. This consists of an entirely new method of finishing crankpins, main bearing journals, and other steel surfaces where there is lubricated metal-to-metal contact. It is claimed that the new method results in longer bearing life and the ability of bearings to withstand greater loads. The new practice will be applied to the 1942 model Buick. Exhaustive tests in the experimental laboratories and on the road have been made.

According to the engineers associated with the new development, finishes of crankpins in the past, as measured by the Profilometer, have an average depth of surface scratches or depressions of 4 to 5 micro-inches (millionths of an inch). In some cases, the finish has been as close as 1.5 to 2 micro-inches. The new practice calls for a "rough" finish of from 40 to 70 micro-inches; this finish, it is stated, having produced a substantial reduction in bearing wear and bearing failures.

Artificial roughening of smooth steel surfaces has been practiced on such parts as camshafts, pistons, and tappets for the purpose of etching the surface and applying a soft coating material which would have a wick action and absorb oil, so that the initial scuffing of moving metal surfaces would be minimized. Electrolytic, chemical, and heat treatments have been used successfully in such applications. In the present research, after it was proved that acid-etched journals gave longer bearing life than smooth journals, it was decided to make crankshafts in which the journals would have different degrees of roughness produced mechanically.

Four of the eight connecting-rod journals on a test shaft were ground with deeper grooves or scratches than the usual ground finish. The other four had the standard production finish. After grinding, the experimental journals were polished lightly with abrasive cloth. The shaft was then assembled in an engine and given an endurance run.

After tearing down the engine, it was discovered that the rod bearings on the "rough" journals were in much better condition than those on the smooth journals. This was checked by varying the position of the "rough" journals on other shafts, the same results being obtained in every test.

More endurance runs established a tentative roughness range of from 40 to 70 micro-inches as the best. So convincing and uniform were all tests, that it was decided to specify this range as the production standard for all crankshaft journals, both pins and mains. Such shafts already have been used extensively for a thorough test in production cars.

The theory of the improvement in bearing life shown by actual tests is that lubrication is improved, and, consequently, operating temperatures are substantially reduced.

* * *

Safety Posters Available

The American Optical Co., Southbridge, Mass., has announced that it will place industrial firms who so desire on its mailing list for free safety posters. At intervals during the year, dramatic, colorful safety posters driving home to workers the value of safety precautions are issued by this company; they will be mailed to concerns wishing to receive them.

MACHINERY'S DATA SHEETS 451 and 452

TYPICAL APPLICATIONS OF SAE STEELS—1

This listing, based on the 1941 SAE classification of steels, is not intended to be complete, but rather to indicate by typical examples what steels are suitable for various types of applications.

Agricultural Machinery Parts

Medium-carbon steel No. 1060 is used for such parts as frogs and standards.

Medium-carbon steel No. 1070 is used in cold-rolled or planished form for mower section, plow beams, and other parts.

High-carbon steel No. 1075 is used for cultivator disks, coulter blades, and plows.

High-carbon steel No. 1080 is used for plowshares, twine-holders, knotter disks, springs, molds, shovels, and harrow and plow disks.

High-carbon steels Nos. 1085 and 1095 are used for mower knives.

High-carbon steels Nos. 1090 and 1095 are used for harrow and seeder disks, seat springs, hay-rake teeth, and bundle-carrier teeth for binders.

Automatic Screw Machine Parts

Free cutting steel No. 1112, often called "screw stock," has excellent machining properties, but also has the unfavorable property of cold-shortness and should not be used for vital parts.

Free cutting steel No. X1112, a higher sulphur variant, has improved finish and machinability. It should not be used for vital parts, however.

Free cutting steel No. 1115, also known as "open-hearth screw stock," is somewhat inferior to steels Nos. 1112 and X1112 in machining properties, but has better strength and toughness.

Chromium-nickel austenitic steel No. 30615 is available in two types, which may be used interchangeably.

Stainless chromium iron No. X51410.

Automobile Body and Panel Stock

Low-carbon steels Nos. 1010 and 1015 provide excellent surface finish. For maximum strength, cold-drawn or cold-rolled sheets should be specified.

Axles

Medium-carbon steel No. 1040 has fair machining properties and deep hardening characteristics. Suitable for small and medium-sized plain carbon-steel forgings, such as rear axles, and tubular and solid front axles.

Medium-carbon steel No. 1045 is intended for the larger sizes of plain carbon-steel forgings.

Medium-carbon steel No. 1050 is intended for parts of larger section than steel No. 1045.

Nickel steels Nos. 2340 and 2345 are used where greater strength and toughness are required.

Nickel-chromium steels Nos. 3135 and 3140.

Nickel-chromium steel No. X3140 is used for axles of larger section than are made with steel No. 3140.

Nickel-chromium steels Nos. 3245 and 3250 are used for oil-hardened parts requiring very high physical properties, such as heavy-duty axle shafts.

Molybdenum steel No. X4130 is used to some extent for axles.

Molybdenum steel No. 4140 is used extensively for rear axles and front-axle tubing.

Chromium-nickel-molybdenum steel No. X4340 is suitable for oil-hardening axles where high strength and anti-fatigue properties are required.

Chromium alloy steel No. 5140 may be used interchangeably with steels Nos. 2340 and 3140.

Medium-carbon grade chromium-vanadium steel No. 6135.

MACHINERY'S Data Sheet No. 451, October, 1941

TYPICAL APPLICATIONS OF SAE STEELS—2

This listing, based on the 1941 SAE classification of steels, is not intended to be complete, but rather to indicate by typical examples what steels are suitable for various types of applications.

Balls

High-carbon steels Nos. 1090 and 1095.

Chromium steel No. 52100 is used for balls for anti-friction bearings.

Bearings, Ball

Chromium steel No. 52100, used for races and balls.

Bearings, Roller

Molybdenum steels Nos. 4815 and 4820 have excellent core and surface hardness, together with good wear resistance.

Chromium steel No. 52100 is used for both races and rollers.

Bolts

Low-carbon steel No. X1025 is suitable for hub and rim bolts.

Medium-carbon steel No. 1035 is a fair machining steel for small and medium-sized forgings requiring moderate physical properties.

Medium-carbon steel No. 1040 has fair machining properties and deep hardening characteristics. It is suitable for anchor bolts.

Free cutting steel No. 1112, used for screw stock, has excellent machining properties, but also has the unfavorable property of cold-shortness and is not suitable for vital parts. It has excellent strength in the cold-drawn or cold-rolled condition.

Free cutting steel No. X1112, a higher sulphur variant providing improved finish and machinability, is used only where production speed and excellent finish are paramount requirements.

Free cutting steel No. 1115, also known as "open-hearth screw stock," is somewhat inferior to steels Nos. 1112 and X1112 in machining properties, but has better combination of strength and toughness.

Nickel steel No. 2330 is used where considerable strength and toughness are required, as in heat-treated bolts.

Nickel-chromium steel No. 3130 is used for water-quenched parts where greater strength is required than can be obtained with plain carbon steels, as for steering-arm and connecting-rod bolts.

Molybdenum steels Nos. 4815 and 4820 are used for bolts of high strength. They have excellent core and surface hardness and good wear resistance.

Brackets

Low-carbon steel No. 1030 is used for forged, machined, or cold-worked parts requiring higher physical properties than are obtainable in the lower carbon steels. It machines satisfactorily either without annealing or after a simple normalizing.

Bumper Bars, Automobile

High-carbon steels Nos. 1085 and 1090.

Camshafts

Low-carbon steel No. 1020 is a standard carburizing grade. It does not respond materially to heat-treatment unless carburized or cyanided.

Low-carbon steel No. X1020, a higher manganese variant has improved machining and hardening properties, and carburizes and hardens freer from soft spots.

MACHINERY'S Data Sheet No. 452, October, 1941

Preventing Industrial Espionage and Sabotage

An Outline of the Work Done by the Federal Bureau of Investigation in Aiding Industry to Combat Espionage and Sabotage in Manufacturing Plants

THE control and prevention of industrial espionage and sabotage are of primary importance in connection with national defense activities. Work in this connection, as far as the Government is concerned, is under the direction of the Federal Bureau of Investigation, of which John Edgar Hoover is director.

There is a general need for vigilance on the part of every citizen to effectively guard against any acts of sabotage being committed in the industrial plants of the nation. This vigilance should not result in violence or mass hysteria, but everyone should be on the alert to report information concerning acts of sabotage to the Federal Bureau of Investigation, Washington, D. C.

The defense against espionage is counter-espionage. Men connected with the Federal Bureau of Investigation keep the suspects under surveillance; scrutinize their activities; keep a record of their friends, acquaintances, and contacts; and are ready to take them into custody when sufficient proof has been obtained or when danger of damage to life or property is imminent.

Many types of information are sought by the men acting as espionage agents. They are particularly interested in industrial data. They gather facts pertaining to improved methods of production, the type of material being produced, the rate of production, production capacity, and the quantity of machines, devices, or articles ordered by the United States and by other governments. They also seek information on designs, specifications, formulas, plant lay-outs, etc.—anything connected with the design and manufacture of munitions and war equipment. They are always anxious to obtain test records of newly developed airplanes, guns, explosives, torpedoes, tanks, rifles, and other war equipment. Drawings, specifications, and reports of tests are of especial interest to them.

Methods Employed by Foreign Espionage Agents

How does the espionage agent work? That question is not easy to answer directly, because their methods vary in a hundred ways, and they exhibit unusual ingenuity in collecting information for their governments. Often they seek and find employment in aircraft and munition plants, where they are able to directly observe, acquire information, and obtain drawings and specifications by under-hand methods. They purchase information from other employes who are not directly espionage agents, and are always ready to either steal or purchase drawings, specifications, and other confidential documents. Valuable documents may be copied, and products and drawings are surreptitiously photographed. Sometimes working models have been stolen outright; sometimes they have been reproduced.

Frequently they work outside the plant by questioning employes under various pretexts. The corner saloon is not a bad place for the espionage agent to obtain information about types of equipment being built and the volume of production. Important employes familiar with the production of confidential war materials may even be offered positions to serve in an advisory capacity on the production of similar war material, because foreign espionage organizations are frequently disguised as commercial concerns, scientific organizations, or even engineering societies, who attempt to obtain information for the benefit of their foreign government. In that way, the foreign agent is often able to openly, personally observe and obtain valuable information on production operations, test runs, etc.

One of the meanest methods used, and one that has been applied especially to refugees in the United States, is to obtain the desired information by pressure—by threats of harm to relatives and friends residing in a foreign country.

Experience with Industrial Espionage and Sabotage during the Last War

Our experience during the first World War gives us an idea of what, without doubt, is going on today. Since we are not as yet openly at war with any foreign power, our hands are somewhat tied in completely guarding ourselves against the menace of certain foreign agents. In the last war, one of the most capable espionage agents to operate in this country was Franz von Rintelen, who was an

officer of high rank in the German army, and who had visited the United States in 1905 to study banking. During this visit, he necessarily made many contacts with prominent financiers and also established valuable social contacts in New York City and elsewhere.

Upon his return to the United States in 1915, he was provided with practically unlimited funds. Special agents of the Federal Bureau of Investigation found that he was employing numerous people in America who were aiding him in preventing the shipment of munitions to the allied nations. He employed a chemist in connection with a plan to blow up or set fire to ships by using chemical bombs, prepared by the chemist, which were placed in containers and stored away among the cargo of the ships. These bombs were perfectly timed so that they would not detonate and set fire to the ships until they had been at sea for several days. Rintelen escaped from the United States to England, where he was apprehended. He was later returned to this country and tried and convicted in the Federal Courts on several charges.

Industrial Sabotage and Its Methods

Sabotage is not so old as espionage, but there is a close relationship between the two. Invariably, where you find one, you will find the other. Each involves more than merely dealing in military secrets. They reach out to all phases of industrial life. The man hired to do sabotage has as many methods as there are methods of disabling plants, damaging materials and supplies, crippling power, and interfering with the manufacture of every type of product in a modern industrial community.

Damage to machines may be done by breakage that may appear accidental or by chemicals and abrasives that damage bearings or other moving parts. Entire plants may be damaged by bombs and explosives or by setting fires. If a foreign agent is in the employ of a manufacturing company, his opportunities for sabotage are greater than for espionage and the fight against him is often more difficult. Hence, the importance of carefully scrutinizing the records of all new employes, especially those born in and descended from parents born in a country to whose interest it would be to have American manufacturing plants sabotaged.

What is Being Done to Fight Industrial Sabotage?

One of the first steps in the fight against both espionage and sabotage was the plant survey program which was undertaken late in 1939 by the Federal Bureau of Investigation at the request of the War and Navy Departments. As a result, surveys of the protective facilities of a number of American basic industries whose products are vital to national defense have been undertaken. About 2400 plants are on the list of these key industrial facilities. Already over 1800 of them have been surveyed. In addition, some 12,000 industrial plants may later be covered by this effort.

The investigation covers solely the prevention of espionage and sabotage, and has no bearing whatever on the regular employer-employe relationships within the plant. This work has been undertaken with great thoroughness. First, as a result of research made by staff members of the Federal Bureau of Investigation, a manual of instructions on the subject of plant surveys was prepared and furnished to all those agents of the Bureau who are engaged in this type of work. In addition, any man assigned to this type of investigation is first placed in a special training school in Washington, operated in connection with this project.

The agent then goes to the plant to which he is assigned and investigates the means taken to provide safety against espionage and sabotage. He gives especial attention to all vulnerable points, as well as fire and other hazards. He submits a detailed report to Washington, which is reviewed by men thoroughly trained in industrial protection. The Federal Bureau of Investigation then submits a comprehensive list of recommendations to the chief executive of the industrial plant. Although these recommendations are not compulsory, the cooperation of the managers of industrial plants has been outstanding.

Laxity in Regard to Protective Measures Often Found

Indicative of the need of a survey program such as that being carried out by the Federal Bureau of Investigation, are instances of laxity which have been noted in some of the plants inspected. In one plant manufacturing a secret type of war material, for example, those in charge of engineering had orders to guard blueprints, drawings, and other important data with the greatest care. Each night the confidential records were locked in a presumably burglar-proof concrete vault. When the Bureau's special agent looked over the vault, he found an almost unbelievable fact—that in the rear wall of the vault there was a window of ordinary glass overlooking a small landing leading to the yard of the plant, making it a simple matter for anyone to enter the vault from the yard and remove its entire contents. Needless to say, this condition was remedied immediately when brought to the attention of the higher plant officials.

In another plant, elaborate precautions had been taken in connection with the checking out of blueprints to the workmen. When the Bureau's agent asked the plant executives for the name of the employe who supervised the checking-out system, it was found that they did not know his name. The payroll records, however, came to the rescue, showing that the man in charge of the blueprints had been hired but a few days previously without any investigation whatsoever into his background.

It so happened that the man was a loyal American citizen, but a foreign agent could have found here a lucrative source of information.

Care Must be Taken to Prevent Unauthorized Persons from Entering Plants

In the case of one very important plant engaged in the manufacture of war materials, the Bureau's agent was able to enter the plant at each of its three entrances in succession without being questioned by anyone, although he wore no identifying badge. He was able to walk through the entire plant, mingle with the workers, and ask questions without anyone stopping him. In order to be able to point out the seriousness of the matter, he made inquiries about highly confidential activities, asking questions and receiving courteous and informative answers without anyone questioning his identity or purpose.

To prevent occurrences of this kind, the Bureau recommends that every employe and official in manufacturing plants of this character should carry an identifying credential card. The card should contain the employment number, name, physical description, and photograph of the employe, and his assignment or duties in the plant. Employes should be held directly accountable for these credential cards, and should never be permitted to enter the plant without displaying them at the gates or entrance doors. In addition, the Bureau recommends that badges with employment numbers, of different colors and shapes to designate shop departments, be carried and worn by employes at all times on the plant property. With such identification, a stranger could no longer move about freely without being suspected.

In some plants, it has been recommended that wire fences be installed, in order to safeguard against trespassers. In one factory it was found that an old unused water drain of huge proportions, located in the foundry, offered a means of entrance to the plant for anyone bent upon wanton destruction of equipment or other property.

In one airplane factory, practically no precautions were taken to protect a secret model which was being tried out in an experimental hangar. The one precaution taken consisted of a partition at one end of the hangar, but in this partition there was a large hole. Upon inquiry why that hole was made and why it had not been repaired, the answer was that one of the employes had kicked a hole in the partition so that he could see the new experimental plane. A possible foreign agent working as an employe in the plant could also see the plane through that hole.

The Problem of Fire Hazards

An important problem in all industrial plants is the danger of fire and the need for adequate fire-fighting equipment. Fire is always an effective weapon of the man bent upon sabotage. The starting of a fire can often be thought accidental. In one factory, the Bureau's agent found that oil from a large pile of oil-soaked metal shavings had formed into small pools about a warehouse floor. This warehouse was the storage place for gasoline used in motor tests. A lighted cigarette "accidentally" dropped would have sent the entire plant up in flames and would have halted important production. Rooms in which waste paper is baled and stored present a constant fire hazard. In one case, such a room had several fire extinguishers, but the inspection tag on one of them showed that it had not been inspected since 1936. Fire extinguishers should be checked at least once a year.

In many machine shops, floors are oil-soaked, yet smoking is allowed and fire equipment is insufficient. Employes' clothes and waste material are not kept in fireproof lockers and containers. Electric switches are frequently not enclosed. In plants of this character, there are many opportunities for men bent on sabotage.

Admitting Unidentified Visitors to Defense Plants

Great care should be taken in admitting visitors to plants. In one of our largest machine tool manufacturing plants, there was, until recently, no provision whatever for preventing practically unidentified visitors from walking into the offices, and from the offices into the plant. It may be necessary to admit comparative strangers to the offices, but certainly strict means should be provided for preventing such persons from entering the manufacturing departments without authority and proper supervision.

The foregoing are some examples of dangerous situations that have been eliminated by the preventive work of the Federal Bureau of Investigation. Although several cases of actual sabotage have occurred, it appears that so far they have been the efforts of individuals. They have not been the technically perfect efforts of organized groups of foreign agents. It is just as foolish to cry sabotage every time an industrial accident occurs as it is to neglect to take the necessary precautions. Normal industrial accidents will occur. Fires and explosions always occur, even in peacetime. It is, however, well to note whether the number of fires and explosions show any appreciable increase over normal years. The added industrial activity should, of course, also be taken into account.

The sum and substance of the whole thing is that manufacturers should carefully scrutinize the background of their employes, both their older employes and those who are being hired. They should take measures to prevent unidentified persons from entering the plant property, and they should take more than ordinary precautions against fires, explosions, and similar hazards which may be accidental and which, for that reason, are the tools most likely to be used by the saboteur, as they are not so readily detected.

Important Points in the Design of Welding Fixtures

Abstract of a Study Submitted by T. F. Rataiczak and G. B. Fox of the Hobart Mfg. Co., Troy, Ohio, to the James F. Lincoln Arc Welding Foundation, Cleveland, in a Recent Award Program

IN the design of welding fixtures, there are a number of important factors that must be considered if satisfactory results are to be obtained. These are accessibility, rigidity, ease of loading, ease of removing welded work, backing strips, adjustability, and cost.

It may seem obvious that the welder should have easy access to the joint to be welded. Nevertheless, in some of the first attempts at designing fixtures, the importance of this feature was overlooked. It was only when designers had learned that, at best, the welders are under a tremendous handicap when working in awkward positions that sufficient space was allowed for the manipulation of the electrode and holder. Coupled with this need for space is the necessity of being able to see the weld clearly at all times. The design of the fixture also should be such as to impose the least possible strain on the operator.

It is well to have the fixture arranged so that it can be turned to the angle that is most advantageous. Sometimes several changes in angular position may be necessary to secure the proper degree of accessibility. In such a case, a counterweight may be advisable, so that changes in position of the work can be effected without waste effort. Once the best positions have been found, locating points or stops should be provided, so that repeated settings can be made easily and quickly.

A welding fixture should be rigid enough to hold the parts to be welded accurately in position without noticeable distortion of either the parts or the fixture. The accuracy of a weak fixture is almost sure to be destroyed by the repeated clampings required in removing and inserting successive workpieces and by hard usage or abuse.

The fixture must be easy to load, and, if possible, "fool-proof" in this respect. Its construction should be such that errors in the placement of parts can be detected easily, if not prevented entirely. Much spoiled work can be avoided by careful planning for easy and correct loading.

After the parts have been welded, it is essential that their removal from the fixture can be effected easily and quickly without prying or straining. For some of the structures studied, this feature provided a major problem. It is not uncommon to forget the fact that, once the parts of the workpiece are welded together, the welded whole may not slide out of the fixture as easily as the uncon-

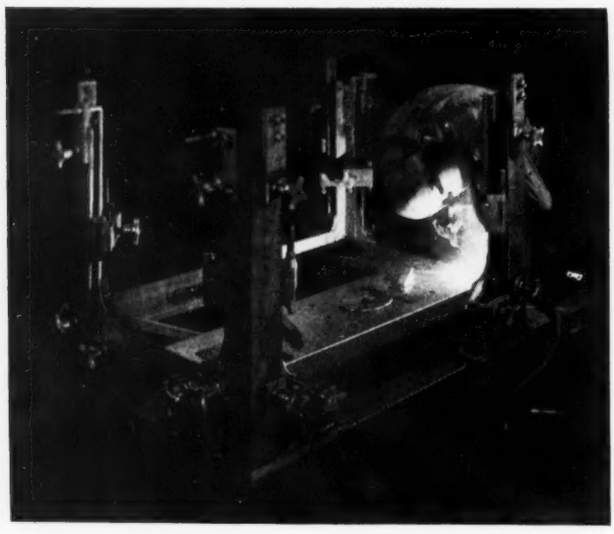


Fig. 1. Fixture Designed to Accommodate Frames of Various Lengths. The Two Clamp Supports Nearest the Welder are Adjustable along the Base Rails

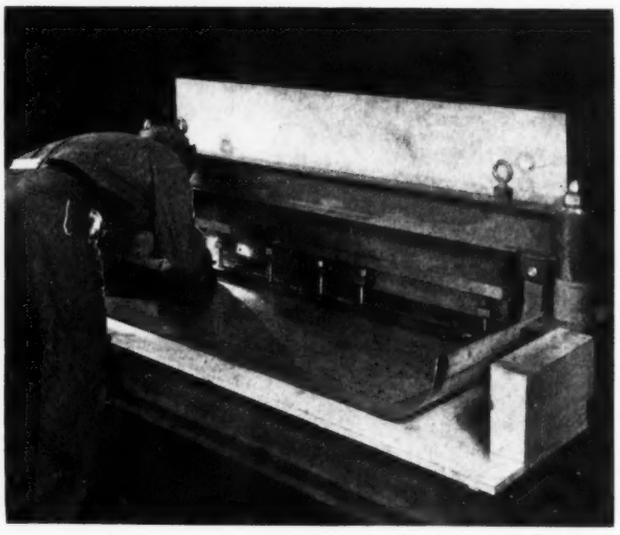


Fig. 2. Fixture with Means for Relieving Clamping Pressure for Unloading. Curved Gripper at End of Arch Bar can be Swung Inward for Work Removal

nected parts slid in. It is necessary, therefore, to provide one or more relief arrangements, so that the fixture can be loosened or opened up to permit easy withdrawal of the welded part.

In the arc-welding of comparatively thin metal, we have found it very desirable, if not essential, to provide the fixtures with backing and gripping jaws of heavy copper.

Adjustability an Important Factor

Adjustability may be considered from two angles. The fixture should be adjustable as to position to suit the welder. It may also be desirable to construct it so that it will accommodate parts for machines of several sizes. Fig. 1 shows a good example of a fixture designed to accommodate frames of various lengths. It will be seen that the clamp supports nearest the welder in the illustration are adjustable along the rails which form the base or frame of the fixture. The removal of four bolts makes it possible to move the clamp supports to any of several predetermined positions to accommodate bases of different lengths.

Fig. 2 shows another fixture that is adjustable for length. This fixture is used for making wash chambers for several sizes of large dish washers. The arch bar with the eyebolts in it is only one of several that can be used on this fixture. A change of arch bar also requires a change of clamp or gripper strip along the weld. On this fixture can also be seen the means provided for relieving the pressure or contact to permit easy removal of the work. It will be noted that the curved gripper shown at the right-hand end of the fixture is hinged to the arch bar. Loosening a horizontal screw at the extreme right of the horizontal clamp or grip permits the curved gripper to move inward sufficiently so that the arch bar can be lifted off without damage to the copper facing or the chamber. The horizontal grip is made in sections of such lengths that various combinations can be used for the different lengths of chambers.

It goes without saying that the cost of any welding fixture should be kept down to a point that is consistent with the number of parts to be produced on it. Many arc-welded jobs can be and are performed without fixtures; but where interchangeable work of the nature required in the building of dish washers is called for, fixtures are not only desirable, but may be necessary. It will be noted that in the building of the fixtures shown in the accompanying illustrations, simple structural shapes have been used to good effect. By the use of arc welding to join these structural members, the cost has been kept within reasonable limits.

In Fig. 3 is shown the front view of a welding fixture of very low cost. The design of this fixture

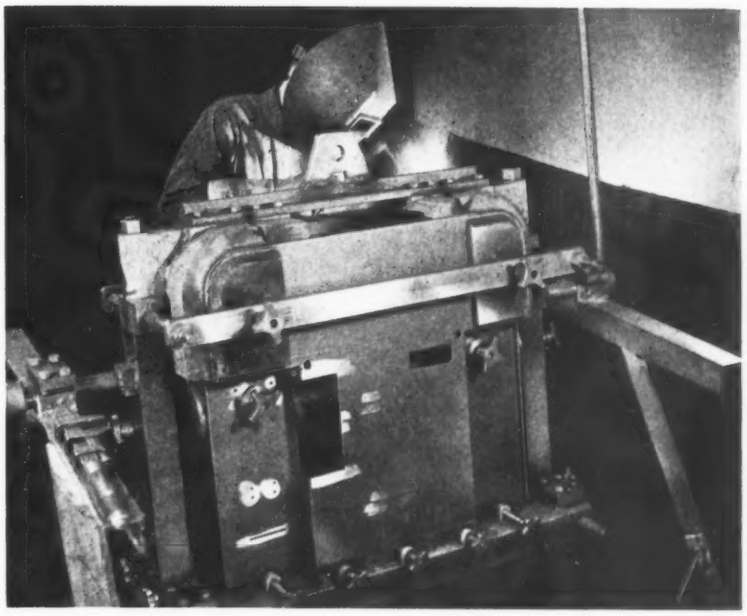


Fig. 3. Welding Fixture of Low Cost for Moderate Number of Parts. Accurate Construction for Exact Part Alignment was a Controlling Factor in This Design

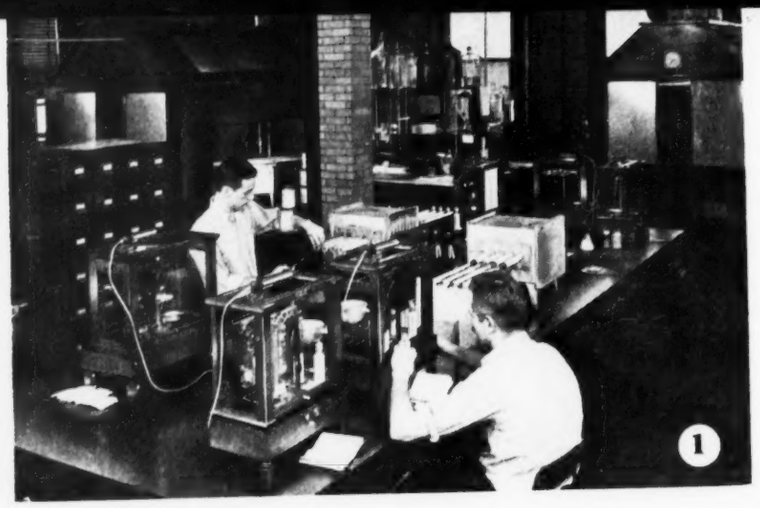
presented several problems: (1) Only a moderate number of parts were to be made. (2) The parts had to be accurate as to size and shape. (3) The parts were to be of fairly thin material. (4) The work had welds on all sides, as well as inside, which made it necessary that the fixture be adjustable as to position. (5) The work consisted of four major pieces and several small internal pieces, which had to be accurately located with respect to one another. Another controlling factor was that not more than 0.010 inch of "rock" was permitted after welding when the base of the work was resting on a surface plate. (6) After fabrication, the work was to house a system of finish-machined castings, and all holes and openings had to be in accurate alignment. In spite of the fact that it was a most difficult job, the designer succeeded in producing the fixture shown at comparatively low cost, and it proved to be more successful in aiding production than had been anticipated.

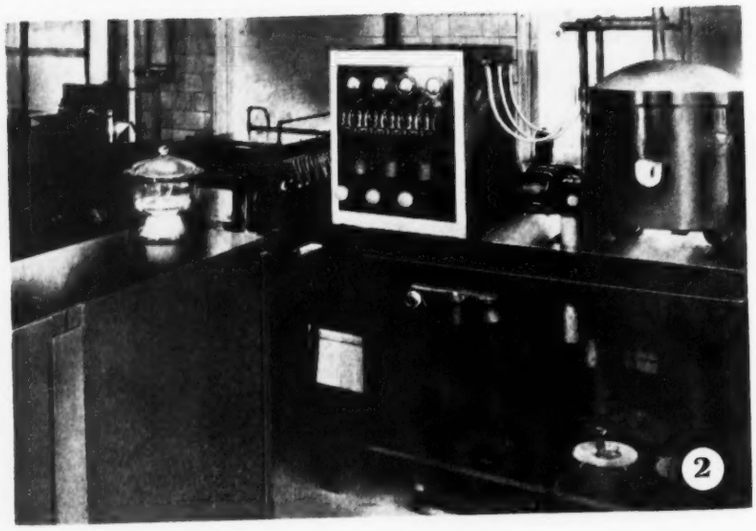
In welding work, much of the success that we have had must be attributed to the advances made in the design of arc-welding machines, and particularly to the improvements in welding rods. Many of the jobs being done today with comparative ease were considered impractical or impossible only a short time ago.

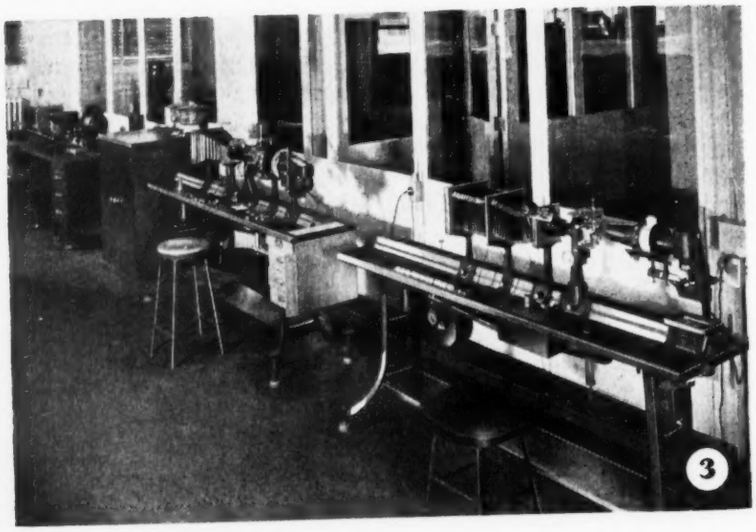
* * *

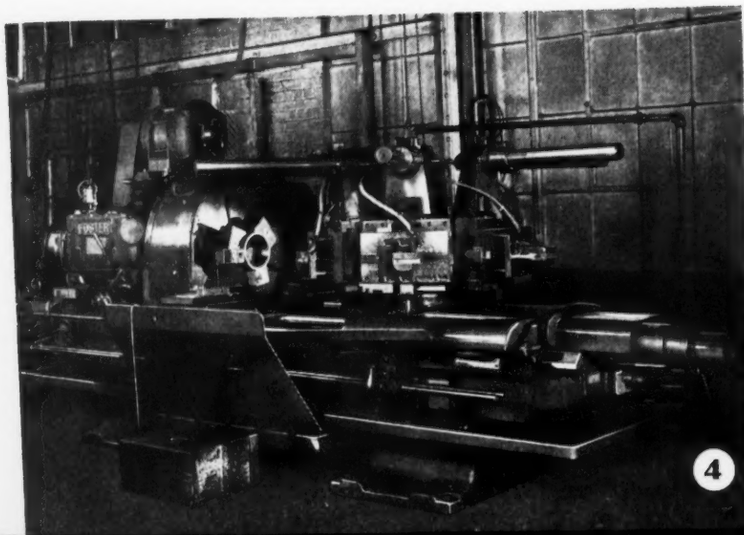
A 5- by 3-foot by 10-inch surface block weighing close to 3 tons, installed in the plant of the Timken Roller Bearing Co., Canton, Ohio, is believed to hold the world's record for flatness. It is finished to such a degree of accuracy that no point on its surface is more than 0.0001 inch higher than any other point.

Some Steps Timken Heavy









IN the manufacture of Timken heavy-duty industrial and railroad roller bearings, the first steps are taken in the laboratories. The alloy steel for the bearings is made in the company's own steel mill. Before the alloy steel is made, during its manufacture, and after it has been made, the chemical laboratory (Fig. 1) checks each step, and analyzes the steel for its chemical contents. Here the content of every heat of steel is checked—not once, but many times—during the melting process. The laboratory functions day and night.

In the research laboratory (Fig. 2), pounds of steel instead of tons are first made and subjected to all the chemical and physical tests required. These research trial heats begin in a small electric arc furnace, after which they are duplicated in a one-ton furnace, and then in a 5- to 10-ton unit. If the results obtained in all these trial heats are satisfactory, the steel is made in 30-ton electric furnaces; and when all problems are solved, it is made for production purposes in what is said to be the world's largest electric furnace, in which 90 tons of alloy steel are made in a single heat.

The metallurgical laboratory (Fig. 3) examines the structure of the finished steel to determine grain size and uniformity. After all tests have proved satisfactory, the steel passes to the forge shop and the machining departments, where it is converted into roller bearings.

Fig. 4 shows the rough- and finish-turning of the inside face of heavy-duty double-row bearing cups from forgings. When the inner surfaces and the outer face have been finish-turned, the piece is transferred to a companion machine which finishes the outer surface. Fig. 5 shows a close-up view of a roughing cut being taken on the front tapered surface of the bearing cup.

To assure uniform spacing of the rollers, either pressed-steel or pin type cages are used. Fig. 6 shows some of the larger types of cages being formed in a heavy-duty press. Six distinct op-

in Making Roller Bearings

erations are involved in the making of pressed-steel cages requiring very great accuracy. To meet the need for heavy-duty, long-lived, accurate dies and punches, the Timken company has developed a new kind of die steel which has given highly satisfactory results.

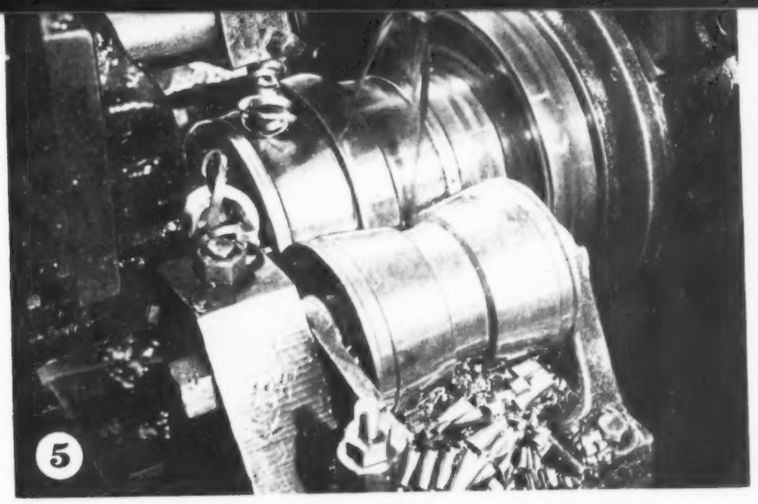
Fig. 7 shows one of the last operations in the finishing of the bearings. In this illustration, a shaped or formed grinding wheel is being dressed to maintain the smooth uniform cutting surface required for finish-grinding the tapered face and ribs on a heavy-duty industrial bearing.

Before assembly into the final bearing, every cup, cone, or roller must pass a rigid inspection. Fig. 8 shows one step in the progress of the cone inspection in the railroad bearing division. Here the diameter and taper are being checked with a knife-edge gage. No light must pass between the knife-edge gage and the wearing surface of the cone. A variation of even a fraction of a thousandth of an inch in size would permit light to pass; hence this method of inspection assures a high degree of accuracy.

* * *

Requirements of an Ideal Planer Drive

In an address by John E. Doran, sales manager of the G. A. Gray Co., planer manufacturer, of Cincinnati, Ohio, the requirements of an ideal planer drive were listed as follows: (1) Smoothness; (2) accuracy of reversal; (3) high rate of acceleration and deceleration (efficiency); (4) wide speed range; (5) good speed regulation; (6) reliability (low maintenance); (7) safety (in case of failure, no serious damage should occur); (8) satisfactory speed torque characteristics; (9) good overload capacity; (10) not sensitive to supply voltage fluctuations; (11) accurate and convenient control; (12) minimum shop space; (13) must not have objectionable peak loads at reversal; and (14) reasonable first cost.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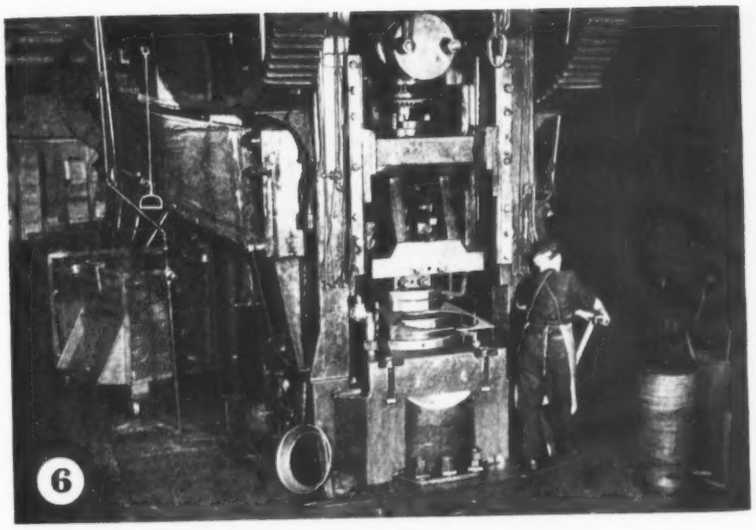
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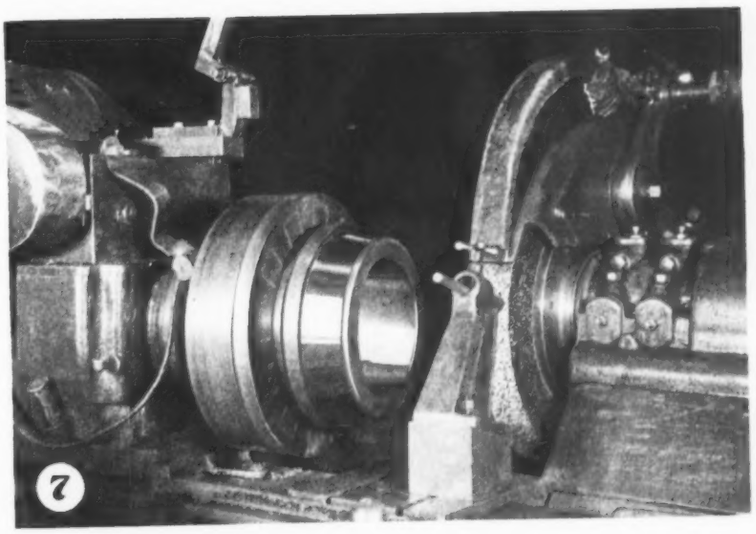
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Engineering News Flashes

World's Fastest and Highest-Powered Cold Strip Mill

A new five-stand cold strip mill incorporating a number of innovations in electric drive and control for steel mills has recently been put into operation at the Irvin Works of the Carnegie-Illinois Steel Corporation near Pittsburgh, Pa. This is the highest powered cold-rolling mill for sheet products in the world. It has been operated at a delivery speed as high as 3750 feet per minute, and is capable of a delivery speed of 3850 feet per minute without exceeding the specified ratings of the mill driving motors.

A total of 11,400 H.P. is employed to drive the mill. The motors are of a special mill type designed by the General Electric Co. A spectacular innovation as regards size is also represented by the two 4000-kilowatt generators, which are the largest direct-current generators ever built. These supply power to the main mill motors and tension reel.

Installed between the five stands are four indicating tensiometers which enable the operators to read the actual pounds of strip tension as the strip proceeds through the mill. The tension control between the stands provides for a more uniform finishing gage at lower strip speeds. Automatically, at low strip speeds, this control system permits the tension to be increased, so that the finished strip may be "on gage."

Power Amplification of 100,000 with Simple Mercury Control

A column of mercury in a glass tube, one of the oldest devices for measuring temperature or atmospheric pressure, has been turned experimentally into an ingenious new device that may become the basis of one of the most versatile systems of regulating the speed of a motor.

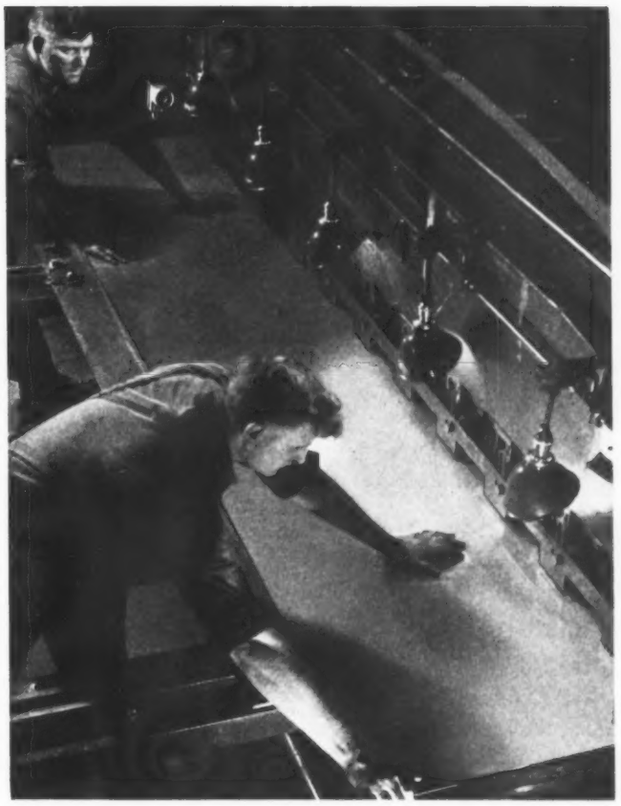
Instead of using a glass bulb below the column to act as a mercury reservoir, a Westinghouse research engineer, K. A. Oplinger, uses a stainless-steel bellows. Sealed into the column rising above it are electrical contacts, spaced roughly 1/16 inch apart. When the bellows is compressed, the mercury rises and successively short-circuits the electrical contacts, thus forming a series of mercury switches.

Because of the large ratio of bellows area to the cross-section of the capillary, only a slight compression of the bellows raises the mercury the full height of the tube. In fact, in an experimental model, a movement of the bellows of only 0.015 inch covers or uncovers the forty contacts, a ratio of about 150 to 1. The bellows can be actuated by a mechanical driver, such as a cam or lever, so it can be used as a speed-control device, contacts in the tube controlling a motor rheostat; or an electromagnetic element can make it respond to changes in voltage or current.

The device is, in effect, an amplifier. The full mercury column can be raised by a change of 0.05 watt in the coil driving the bellows. Change in power control may be 5000 watts; thus power amplification is 100,000.

A 39,000-K.V.A. Water-wheel Generator Yoke being Welded on a New, Large Hydraulic Welding Positioner in the Tank and Plate Shops of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. This 50,000-pound Piece is Close to 39 Feet Outside Diameter. The Welding Positioner, Said to be the Largest of its Kind, Not Only can be Rotated, but can be Tilted to any Angular Position from the Horizontal to the Vertical, as may Best Suit the Work. It can be Used Effectively, Not Only for Hand Welding, but Also for Automatic Welding, since it can be Made to Move at a Predetermined Welding Speed

A Westinghouse Phototroller Attached to a Cincinnati Shear to Safeguard the Hands of the Operator. When the Operator's Hand Interrupts the Light Beam, the Machine is Immediately Stopped. Similar Devices Making Use of the Electric Eye Principle are being More and More Generally Used for Safety Devices on Shears and Presses



Because of low voltage between adjacent contacts and because the contacts are sealed in a hydrogen atmosphere, relatively large currents can be handled. The device was tried on a 220-volt direct-current circuit, current being varied from 12 to 30 amperes. After five million operations, the contacts showed no sign of wear. It is insensitive to changes in either temperature or pressure.

Steel Industry Produces Steel for Repairing the Human Body

In addition to making steel for defense, the steel industry is also producing steel used in repairing the human body. The Republic Steel Corporation, through its research laboratories at Canton, has produced a type of stainless steel for medical use. This steel is used in the form of plates, screws, nails, and wires in the treatment of fractures. In developing this special type of steel, it was necessary to secure one that would stand constant contraction and expansion, and be free from any chemical or electrical reaction. Thus, a special stainless steel now provides bone surgeons with stronger and more durable metals than formerly available, free from corrosion when placed in human tissues.

Electrically Cleaned Air Protects the War Department Records

Electrically cleaned air is now helping to protect government records against dirt and destructive air-borne sulphur particles in an entire wing of the new United States War Department building. More than 85 per cent of all foreign particles contained in the 500,000 cubic feet of air entering the building each minute are removed by the seven hundred Westinghouse Precipitron cells which form the electrostatic air cleaner. Besides reducing cleaning and maintenance costs, the Precipitrons are expected to prevent records from becoming yellow and brittle due to the presence of sulphur particles in the air.

One of the advantages of the electrostatic cleaner is its ability to remove foreign particles from the air, regardless of their size. This is something that mechanical filters cannot do; they are able to remove only the larger particles. The War Department installation is the third in the Federal Government buildings.

Heating Industrial Equipment to Prevent Breakage in Winter

Cold weather damage to a large 30-yard stripping shovel at the Truax-Traer Coal Co., Fiatt, Ill., has been largely eliminated by installing General Electric Calrod heaters. The dipper handle of the big shovel sometimes snapped during winter operation as a result of the extremely low temperature of the metal. Each breakdown meant an expensive repair bill, in addition to the loss due to an idle shovel.

These breakages have been averted to a considerable extent by the installation of twelve 2000-watt, 230-volt, Calrod heaters around the inner surface of the dipper handle. Heaters are also installed on the dipper itself to solve another costly cold-weather problem. Mud, freezing on the sides and bottom of the dipper, gradually accumulated until the payload of the dipper was reduced by one-half or more. Bonfires and a shut-down of from one-half to one hour were necessary to thaw out the frozen mud. This problem was solved by welding hot plates, heated by Calrod heaters, on each side of the dipper and on the center panel of the door. Another Calrod heater was formed in a circle around the manhole entrance to the dipper handle, where it joins the dipper. A thermostat was attached to close the circuit at 25 degrees F., since no trouble was experienced above that temperature. It is expected that this heating equipment will pay for itself many times over out of the savings resulting from its use.

EDITORIAL COMMENT

Hasty Legislation is Seldom Sound Legislation

Perhaps one of the most serious defects in our governmental machinery is that, since the office-holder is so largely concerned with pleasing the voter in order to become re-elected, long-range policies are neglected, and almost all legislation relates to immediate problems before the public eye. The result is that legislation is enacted hastily, and many ill considered halfway enactments are passed which, when once having become law, close the door to real thoroughgoing measures for a long period to come. As a few examples may be mentioned the Wagner Labor Act, the Selective Service Act, many of our tax laws, and numerous laws affecting industry and business.

At the present time, serious consequences may result from the legislation that permits the President to seize plants in the interest of the national emergency. Obviously, if a manufacturing corporation obstructed the National Defense Program, such seizure would be justified. So far, however, the President's power to seize appears to have been made use of only in cases where certain labor leaders have conspired to hold up defense production through strikes; and, instead of attacking the real problem, the President has fallen back on his power to seize manufacturing plants as a quick, temporary solution—a solution that has doubtless been necessary, but that is a makeshift, nevertheless. With such action should have gone an immediate recommendation to Congress to so amend the Wagner Labor Act that it could not be used by unscrupulous men, who apparently care nothing for the welfare of the nation, to obstruct the production of urgently needed aircraft, ships, and other products required for the defense of our institutions.

Fair Play is All That Anyone Has a Right to Expect

The American public is simply asking for fair play—methods fair to the young men who have been drafted into the Army; fair to the taxpayer; fair to that large proportion of Americans who, whether they work with hand or brain, like to be able to decide for themselves for whom they shall work and under what conditions; fair to the men who create employment; and fair to the country as a whole.

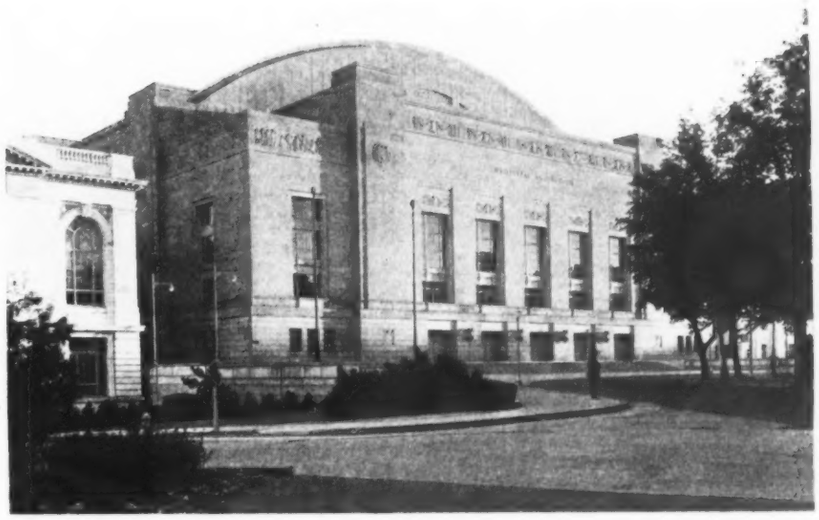
In the past, there were instances of class legislation in one direction. Now the pendulum has swung too far in the other direction, and we have class legislation that has, by the Government's own evidence, played directly into the hands of men said to be communists and racketeers, who have been using labor organizations to serve, not labor, but their own ends.

What all reasonable-minded men want is a return to fair play and to a square deal—legislation that is equally binding on the employer and the employe, that confers upon each the normal and natural rights to which each is entitled in accordance with the primary principle that has been the basis of American life in the past.

Lack of Gages Makes for Resourcefulness in Arms Manufacture

As the war materials manufacturing program progresses, a serious shortage in gages and gaging equipment is becoming apparent. This is partly due to the scarcity of gage-makers and partly to the great demands suddenly placed upon gage-making plants. It is estimated that the armament program will call for three times the number of gages that are normally produced annually. This large increase will be provided for by the plants that have been specially erected for the purpose; but it will require time for these plants to supply the full quota.

Many manufacturers, therefore, have found it necessary to proceed with their armament production without adequate gages. They have made makeshift gages, often from soft steel, in their own shops. While this is an unsatisfactory procedure, such resourcefulness is to be commended, because it is better to maintain production with inadequate machinery and tools than to produce nothing at all. When it comes to devising ingenious makeshifts to keep production going in spite of the lack of necessary equipment, the older mechanics, who were trained at a time when the refinement in manufacturing facilities had not reached the present level, are often more ingenious than the younger men, who have grown up with more adequate equipment. Makeshift methods make it more expensive to produce munitions, but right now, time is more important than expense.



National Metal Exposition

PHILADELPHIA, OCTOBER 20-24

AT the twenty-third annual National Metal Exposition, to be held in the Philadelphia Public Auditorium, Philadelphia, Pa., October 20 to 24, the products of 275 leading manufacturers in the metal industries will be on display and in operation. The men responsible for the Exposition, which is sponsored by the American Society for Metals, feel that there has never been a greater need for an exposition of this character than in this year of gigantic defense preparations. The exhibits have been largely selected with a view to showing thousands of manufacturers and engineers engaged in defense production the latest materials, processes, and equipment for speeding defense work in the metal industries.

Many of those who will attend the Philadelphia exposition have found that in the present emergency they must specify and use materials with which they are not entirely familiar, because these materials have not been required in the lines of manufacture in which they have been engaged. At the exposition, these men will have an unusual opportunity to become acquainted with materials and processes of supreme importance in defense production. The five days at the show may, in some instances, save months of production time for the companies whom these men represent.

In conjunction with the exposition, will be held the National Metal Congress in which participate the American Society for Metals, the American Welding Society, the Wire Association, and the Institute of Metals Division and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

Government officials and production executives of plants manufacturing defense equipment will take part in a series of Defense Forums, which will form one of the main features of this year's National Metal Congress. The purpose of these meetings will be to devise means for increasing defense production and conserving metal resources. Members of the Office of Production Management, the Office of Emergency Management, and the Army and Navy will represent the Government. The industrial side will be represented by leading metallurgists, production engineers, shop superintendents, and other operating executives. By an open discussion of the problems facing both Government and industry, and the frank interchange of ideas, it is hoped that both sides will profit.

Among the topics to be covered at the various sessions are the manufacture of shells; tool steel with special reference to molybdenum high-speed steel; magnesium and aluminum for aircraft and other defense equipment; copper; bearing metals; pig iron; scrap; and priorities. The sessions on the conservation of metals will be devoted to case-hardening; deep-hardening steels; high-strength structural and weldable steels; alloy castings; and stainless and heat-resisting steels.

The exhibitors are cooperating to make the Congress of the greatest service to the nation by emphasizing such products as will aid in speeding national defense production. The men in charge of these exhibits will take part in the Defense Forums and will assist by suggestions relating to new methods for greater productivity.

The sessions of the Congress will be held in downtown Philadelphia hotels and in the assembly rooms of some of the technical and engineering societies in the vicinity.

Application of Metal-Spraying in Equipment Maintenance

IN August MACHINERY, page 168, the use of metal-spraying to effect quick, durable repairs where corrosion and wear have taken their toll was referred to. In the Brooklyn plant of the American Sugar Refining Co., under the direction of Metal Spray Engineer, James W. Gibbons, this method of building up worn surfaces and covering those attacked by corrosion has been used on all sorts of jobs over a period of nine years. During that time, experiments have been conducted with the spraying of almost every kind of metal that seemed to offer advantages, and, in addition, with the spraying of hard rubber, synthetic rubber, and glass.

Although consideration had been given to installing metal-spraying equipment in this plant for some time, the move was precipitated when a governor sleeve on an old turbine became so badly worn that the governor failed to function. Inquiry revealed that the sleeve was no longer manufactured, due to the age of the turbine, and that a period of seven weeks would be required for replacement. Casting about for some possible method of effecting a reasonably quick repair of this piece of vital equipment, it was decided to try metal-spraying. As there was no metal-spraying equipment in the plant, the job was sent out to a nearby shop one evening. The worn sleeve was sand-blasted, metal-sprayed, and finished that night, and returned for service the next morning. It was installed, and the turbine put into operation with entirely satisfactory results. Shortly afterward, the first unit of metal-spraying equipment was purchased, and a highly effective maintenance operation became established practice in the plant.

The repairs in this particular plant fall largely into two classes—the building up of shaft bearings of all types, and the relining of tanks. Before the installation of metal-spraying equipment, the practice was followed of having worn electric motor shafts turned down and smaller bearings installed. After a period of time, this resulted in several different special sizes of bearings being used throughout the plant. When the metal-spraying equipment was installed, however, these motor repairs were effected by building up the shafts and machining and grinding them to their original diameter, so that eventually standard bearing sizes were again in use in all the motors.

Relining Tanks and Processing Equipment

One of the first attempts to spray with hard rubber was in connection with coating the interior of a cast-iron vessel. After careful consideration and discussion, it was decided to spray the bottom cone of this vessel, having an area of about 80 to 90 square feet, with hard rubber. This coating has now been in service about two years and appears to stand up well. Incidentally, it may be mentioned that laboratory tests have shown that hard rubber, as deposited from a metal spray gun, will stand temperatures up to 400 degrees F. without serious deterioration. Another instance in which hard rubber spraying was used was in the case of three steel tanks that customarily operate at a temperature of 120 to 130 degrees F. A deposit of 0.050 to 0.070 inch of rubber was sprayed on these tanks to prevent corrosion.

Several elliptical tanks used on automobile trucks were successfully coated by metal-spraying. These tanks were 20 feet 8 inches long, 7 feet 3 inches across the long axis, and 4 feet 2 inches across the short axis. Each tank had a capacity of approximately 2000 gallons. First a zinc alloy was sprayed on to a thickness of about 0.006 inch, and this was followed by two layers of aluminum, making a coating about 0.020 inch thick. One hundred and eight pounds of zinc alloy and 90 pounds of aluminum alloy were used for each tank, and the total time required for the operation was 184 man-hours for sand-blasting and 290 man-hours for metal-spraying.

A crystallizer tank, 20 feet long and 10 feet in diameter, was sprayed on the inside with tin. The entire job, including the disassembly, sand-blasting, spraying, and reassembly, required 846 man-hours. No other method of saving the tanks seemed feasible, and without this treatment they undoubtedly would have had to be scrapped.

These are only a few of the many maintenance and repair jobs that have been accomplished in this sugar refinery with large resultant savings. The metal-spraying equipment required for all maintenance work in this plant consists of two spray guns, two 2000-pound sand-blasting machines (one portable, the other stationary), together with the necessary auxiliary equipment such as an air compressor, ventilating fans, etc.

* * *

Meehanite Metal Being Used for Tool Shanks

Meehanite metal is now being used for cemented carbide tool shanks. In addition to being inexpensive, Meehanite metal tool shanks are said to reduce vibration and tool chatter. It has also been found that grinding is facilitated, because silicon-carbide wheels do not load up as rapidly with Meehanite as with steel.

Tool Designers Made to Order

By THOMAS P. ORCHARD
Wright Aeronautical Corporation
Paterson, N. J.

A Class being Instructed in Tool Design at the Paterson Plant of the Wright Aeronautical Corporation

WITH its manufacturing facilities increased from less than a million square feet to almost five million square feet in a two-year period, the Wright Aeronautical Corporation was faced with serious difficulty in obtaining an adequate number of skilled tool designers to handle the vastly increased volume of work.

In the beginning of 1939, the company had in its direct employ about fifty tool designers, while an additional ten or twelve were kept busy in the employ of an independent company of production engineers. Today, 120 designers are on the company payroll, and an additional 130 are employed by three independent companies.

The vast expansion program undertaken by all defense plants created an unprecedented demand for the services of skilled tool designers. Facing this condition, the Wright company decided last March to establish a school on its own premises for training young men in tool design. Through the office of the employe training department, a notice was posted in the company's various plants inviting applications for enrollment in this course. As it was not the intention to teach the elements of mechanical drawing in this school, enrollment was restricted to those who had had some training in this work, either in high school, vocational school, or college, and who, in addition, had some machine shop experience. Within a week, well over a hundred applications had been received. These were carefully analyzed and classified, and the men considered suitable were placed on the eligible list.

A separate, completely equipped drafting-room was then set up, and the first class of ten students established under the direction of one of the senior tool designers, who had had considerable experience in teaching. Before being accepted in the school, each student was given a short test in mechanical drawing and in the elementary solution of triangles, in order to make sure that he had some knowledge of how to proceed.

In order that the first few weeks of work should not be entirely unproductive, they are spent in copying mutilated drawings, a considerable number of which have accumulated. Each student is carefully watched until he is able to make a drawing that is professionally acceptable. He is then permitted to handle jobs on which minor changes are to be made, and to design simple tools, such as plug gages and reamers, thus releasing experienced men for more important work. In the later stages of his training, he is permitted to perform detailing work from lay-outs prepared by the regular tool design department. Throughout the training period, the standard operation sheets are used, and the whole process is accomplished in an orthodox manner, so that the individual becomes familiar with regular departmental routine.

After the level of the first class had been raised to a point where it was no longer necessary for the members to do copying work, new students were selected from the eligible list until the enrollment was increased to the full capacity of twenty-four.

During the training period, the students work regular hours, with some over-time, and are paid a salary commensurate with their previous shop experience and training. As each one is considered to be sufficiently trained, he is transferred to the tool design department as a junior tool designer at an increased salary, and a beginner is transferred from the shop to take his place. In this manner, eight students have already been graduated within a period of four and a half months.

Although started as an experiment, this system has proved highly successful, the school-trained men being found, in most cases, to be preferable to new juniors engaged from the outside, since they are already familiar with routine procedures and standard practices. There is no attempt at regimentation in the class. Each student progresses strictly on his own merits, and if unable to show improvement within a reasonable time, is returned to his former occupation without loss of seniority or rating.

When each job is completed, an estimate is made of the hours that would have been required by an experienced designer. This is then compared with

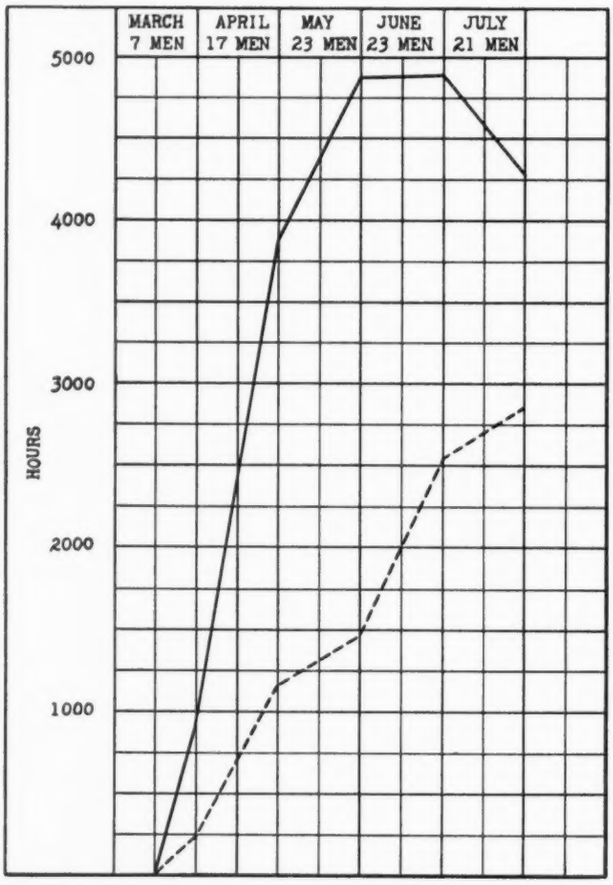


Chart Comparing the Actual Time Taken by the Students and the Time that would have been Required by Experienced Designers. The Full Line is the Time Required by the Students, the Dotted Line that which would have been Required by Experienced Men

the actual time taken by the students, and the monthly total indicated on a chart, as shown in the illustration. It will be noted that the dotted line indicating the number of estimated professional hours, rapidly approaches the full line indicating actual student hours, and shows that even within so short a period as four and a half months, the professional efficiency of the students has reached about 67 per cent. So high, indeed, is the rating of the class at present that a substantial portion of all detailing work is now performed by the students, with the result—entirely unforeseen —that the class is virtually self-supporting.

While excellent opportunities are thus offered to these young men, who would, otherwise, in all probability not have been able to enter this new field, the Wright company is likewise benefiting in many ways from this steady supply of ambitious young tool designers.

* * *

Some of the scarcity of small tools and metals is said to be due to "hoarding." Apparently some manufacturers have laid in larger stocks than present requirements warrant.

Increasing Factory Output by Better Production Control

In a symposium on the subject of how factory output can be increased through improved production control, sponsored by the American Management Association at a meeting in New York City last May, Henry V. Oberg, company industrial engineer of the Armstrong Cork Co., Lancaster, Pa., pointed out how in many plants production can be greatly increased through a study of the capacities of the production equipment and units in the production line under various operating conditions; the cause and extent of delays; and other operation factors that may be of special importance in a particular branch of manufacture. The importance of keeping adequate records of performance was also emphasized. Through such a study in the Armstrong Cork plant, the output was increased 13 per cent in two months' time and it is expected to increase this figure to approximately 25 per cent, with practically no expense for equipment or manufacturing facilities.

Summarizing the program for increasing the output of a production line, the following points were emphasized: (1) Balance the capacities of the units comprising the line; (2) study the operating delays and the causes of idle time, and determine how the delays can be eliminated and the idle time reduced; (3) study the production methods to ascertain that they are actually the best possible under the conditions prevailing; (4) maintain adequate and usable records of performance; and (5) ascertain if the scheduling of the equipment can be improved.

* * *

York Plan Applied to a Large Ordnance Order

The "York Plan," originated in York, Pa., through which manufacturers in a community pool the facilities of their plants for cooperation in handling defense work contracts, has been applied by machinery builders in that city to a large army contract. An ordnance order amounting to approximately $2,000,000 has been awarded to the York Ice Machinery Corporation as prime contractor. The work consists of building harbor defense gun carriages. When bids for these gun carriages were requested several months ago, the York Ice Machinery Corporation immediately consulted with the executives and engineers of the S. Morgan Smith Co., the A. B. Farquhar Co., the Brandt-Warner Mfg. Co., the Read Machinery Co., and other York firms. After studying the plans and checking over the available machinery and man-power in York and neighboring communities, it was decided that the contract could be handled by the cooperative efforts of the various plants, and a bid was submitted to the ordnance officials through the York Ice Machinery Corporation.

Munitions Cleaning—1941 Style

A Review of the Methods and Solvents Applicable to the Cleaning of Shells, Cartridges, Guns, Rifles and Other Materiel—Third of a Series of Articles

By Dr. R. W. MITCHELL, Technical Director
Magnus Chemical Co., Garwood, N. J.

IN the first two articles of this series, the various methods and solvents used in the cleaning of shells were discussed. The present article will describe methods for cleaning cartridge cases.

Cartridge cases for artillery shells, drawn from brass disks, are either loaded with a fixed charge of powder and crimped to the steel shell to form a round of ammunition, ready for loading into the gun in one operation, or else they are loaded with varying powder charges, sealed, and provided separate from the shell for loading following the insertion of the shell into the gun. It is interesting to note that, at present, most American ammunition is of the fixed type, with loaded case and shell a unit, while Canadian ammunition for the corresponding guns is being supplied with separate cases and shells, the former with uniform loadings and the latter with varying propelling charges. This is due to the greater prominence of anti-aircraft work for the artillery under today's conditions, and may indicate a trend in this direction for future American munition supplies.

Drawing the cartridge case from brass disks involves successive operations, with annealing between draws. On the draws, themselves, the dies must be lubricated. Dilute soap solutions are generally used on light-gage or small units, such as machine gun and rifle cartridges. Partially saponified greases are commonly used on heavier work, such as shell cartridge cases. The author believes that a self-emulsifying lubricant of this type, used in water dispersion at from one to eight up to one to twelve parts in water is most satisfactory, both from the viewpoint of die life and that of over-all cost.

Effect of Drawing Compound

For rapid production, it is important to consider the washing characteristics of the drawing compound. Unremoved compound on work going to annealing ovens leads to stains and surface roughening. The self-emulsifying lubricant mentioned is not only very effective as a lubricant, but it has the added value of washing off readily and completely, even with the mildest washing agents. One new drawing compound offers further advantages in that thorough washing between draws is not necessary. It burns off completely during annealing without stain. Containing no mineral or acid ingredients, it leaves no ash to react with the surface of the brass. It is equally effective in molten bath and muffle annealing.

When the common practice of annealing in sodium-nitrate baths is followed, the cases have to be cleaned of residual nitrate after annealing and before the next draw. This procedure is followed, regardless of the nature of the drawing compound used. In some plants, the cases are pickled in sulphuric acid, rinsed, brushed, and then put through the next draw.

It has been found, however, that a more satisfactory job can be done without pickling by the use of a mildly alkaline cleaner with high wetting, penetrating, and dispersing properties. This cleaner is identical with the one recommended for the final cleaning of shells in the preceding article of this series, published in September MACHINERY, page 117. The distinctive properties of this cleaner were discussed in that article. The point to remember is that, by the use of this cleaner, the removal of annealing salts is speeded up and a clean metal surface is provided, on which the drawing compound is more effective and more economical. At the same time, the expense of acid and the possibility of damage due to careless pickling are eliminated. The life of a cleaning solution made of this material and used for cleaning between annealing operations is satisfactory—usually at least a week.

The same dangers in the use of alkaline cleaners based on caustics apply here as in the case of cleaning steel shells, but are much intensified by the nature of the metal involved. Staining of the brass is greater than in the case of the copper rotating band of the shell. This occurs, not only during the washing operation proper, but later, as a result of the poor rinsing properties of cleaners based on caustic alkalies. Residues not rinsed off completely tend to stain still more. The unrinsed caustics cause pitting and poor adherence of lacquer and paint, and it is well to remember that such alkalies tend to withdraw the alkali-soluble zinc metal from the surface of the brass. Again the hazardous nature of such cleaners must be pointed out. They can cause serious burns, and a specific safety procedure must be set up in all cases where such cleaners are used.

Conditions Governing Final Cleaning

The same conditions that apply to the final cleaning of shells apply to the cases. Too strong an alkaline cleaner inevitably leads to staining and excessive rejects. The cleaning job must be quick, rinsing thorough and rapid, and the life of the solution carefully considered, if the operation is to be dependable and economical. As in the case of the shells, the final operation must remove not only adhering oil and grease resulting from machining operations, but embedded metal particles and other foreign matter. A properly selected alkaline type of cleaner will do this job well, but it is important to remember that a good cleaner should not require make-up additions of much over 20 per cent of the initial amount used in making the solution per twenty-four hour shift, and should clean approximately 1000 cases per pound of cleaner within the range of the sizes of shells being discussed.

As previously noted, a mild alkaline cleaner has been found highly suitable for the final cleaning of shells. The same cleaner is well adapted for the cleaning of shell cases. In fact, the performance data presented is the result of a number of cleaning tests conducted in shell producing plants.

In some plants, the cleaning solution is dumped daily and made up fresh, but with the type of cleaner described, the original solution can be used for much longer periods, the time depending on the amount of solid dirt that accumulates. Cases are usually cleaned in still tanks, followed by a cold and hot water rinse, though as industry gets into heavy production, washing machines will probably be increasingly used. A final low-temperature anneal, followed by a light pickle and a sand and sawdust buffing and drying sequence, provides a fine finished case, ready for inspection and shipment to the loading plant.

Cleaning Rifle and Machine-Gun Cartridge Cases

Cartridge cases for rifles, machine guns, and other small arms are drawn with a dilute, non-jelling, non-staining soap solution. Cleaning after drawing is not a very difficult problem; the major factor is thorough contact of the cleaning solution with the interior of the cases, and corresponding thoroughness in rinsing.

The cleaner suggested for the final cleaning of both shells and shell cases is very satisfactory for cleaning small-arms cases, as well. It is, as has been previously noted, a mildly alkaline cleaner with exceptional wetting, penetrating, and dispersing properties, together with unique rinsability. There is no danger of tarnishing the metal of the cases, although rapid and complete loosening and dispersing of the grease and oil are assured.

Small-arms cases are usually washed in lots of 10,000 in a paddle type washing machine having a complete cleaning and rinsing cycle of 4 1/2 minutes. The solution is commonly used at a concentration of 16 pounds per 100 gallons of water, with a temperature just below boiling. It can be run steadily for twenty-four hours, with only such make-up per shift as is needed to compensate for loss by drag out. Recent tests show that this cleaner will clean 5500 cases, or 160 pounds of metal, per pound of cleaner consumed.

This cleaner not only cleans without tarnishing the metal, but is thorough and uniform in its cleaning action. This is important, because any traces of grease remaining on the cases after cleaning will tend to slow up production on the automatic machines used for trimming the cases. The chucks grip the cases very lightly, and slippage caused by grease will stop the machines automatically. Rinsing is rapid and thorough also. Caustic alkalies should be avoided in cleaning small-arms cases, the same as in cleaning shells and shell cases.

* * *

Suggested Cure for Hot Handles on Electrode-Holders

While arc-welding with a 1/4-inch diameter rod, an operator was bothered by excessive heat in the handle of the electrode-holder. An inspection showed that the soft soldered connection between the holder and the welding cable had melted, and the defective electrical contact built up excessive heat rapidly. The trouble was cured by rejoining the cable and holder with a silver brazing alloy.

In repairing the holder, the solder was first melted off the cable and holder. Then these parts were cleaned thoroughly and fluxed with a low-temperature brazing flux. After reassembling the joint, heat was applied with an oxy-acetylene torch, concentrating it upon the connecting lug of the electrode-holder.

As the lug and cable fitting into it came to a dull red heat, a low-temperature brazing alloy known as Easy-Flo was applied. About 4 or 5 inches of 1/16-inch wire flowed in and around the cable, solidifying, and joining it firmly to the holder. No further trouble from excessive heating was experienced, and the operator found that he could concentrate his attention far better on the work to be done.

It is said that the cost of brazing alloy and gases to make a joint of this kind does not exceed five cents. By heating slightly above the flow point of the brazing alloy (1175 degrees F.), a joint can be easily taken apart if necessary.

* * *

Dropping to the lowest monthly value since the latter part of 1939, the exports of industrial machinery from the United States in June amounted to $28,375,000, a decline of 22 per cent from the May total, as reported by the Department of Commerce. Machine tool exports decreased from $19,020,000 in April to $14,390,000 in May and to $11,235,000 in June.

Gas-Fired Furnaces for Heat-Treating Shells and Guns

Abstract of a Paper Presented by F. Coleman Starr of the Surface Combustion Corporation before the American Gas Association at Baltimore, Md.

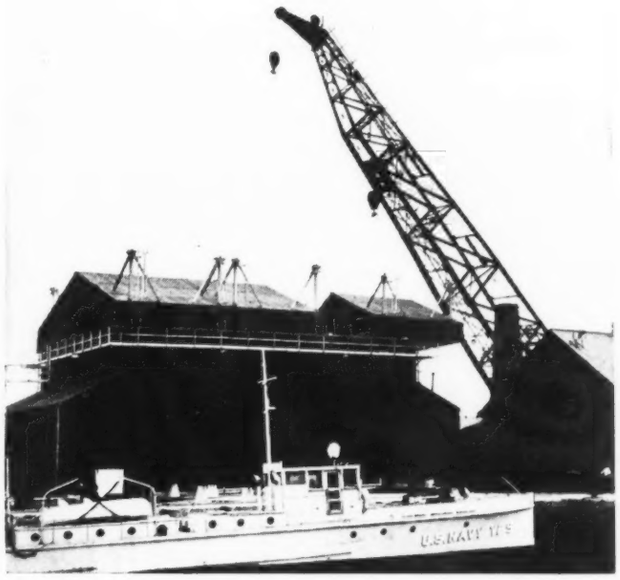


Fig. 1. Huge Furnace for Stress-relieving Gun Barrels and Mounts. This Furnace is Loaded by Removing Portable Roof Sections

THERE is so great a variety of sizes and types of furnaces built for the heat-treating of shells and guns that only a few representative types can be covered here. The very nature of the operations for which these furnaces are being used also imposes restrictions as to the information that can be presented.

Furnaces for the heat-treating of ammunition and guns for aerial warfare may be classified into four broad groups: (1) projectile furnaces; (2) shell-case or cartridge-case furnaces; (3) gun-barrel furnaces; and (4) furnaces for gun mounts, carriages, etc.

Projectile Furnaces

Several heat-treating operations are carried on in a projectile furnace, and a variety of furnace types are suitable for each of these operations. Thus, for projectile forging, there are rotary, pusher, conveyor, and batch (in-and-out) types of furnaces; for projectile nosing, rotary and batch type furnaces; for projectile normalizing, walking-beam, pusher, and rotary types; and for projectile hardening and drawing, walking-beam, pusher, rotary, and conveyor types.

For the forging or subsequent heat-treatment of the larger shells in sizes ranging from 0.50-caliber machine-gun bullets to 4.5- or 5-inch diameter shells, the Surface Combustion Corporation has built a number of gas-fired rotary furnaces, such as that shown in Fig. 2. One of these has the following specifications: The outside diameter of the furnace casing is 23 feet, the rotating hearth is 3 feet wide, with a mean diameter of about 17 feet. The hearth is built up of firebrick piers, capped with alloy plates. This unit has a capacity of 8000 pounds per hour of airplane-engine cylinders or shells and a temperature range of from 800 to 1800 degrees F. It is direct-fired, over and under, by means of high-pressure gas burners, and for the lower temperature ranges, the Conjecto method of firing has been applied, in order to insure uniformity of temperature.

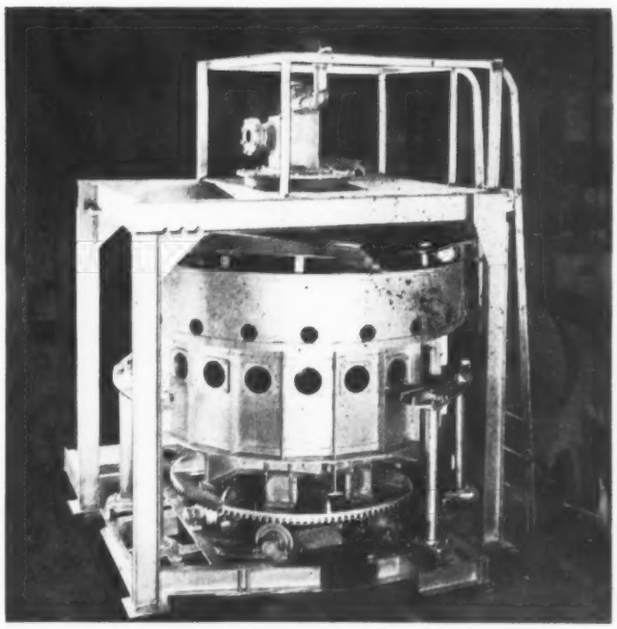


Fig. 2. Rotary Shell Nosing Furnace in Use at the Key Co.'s Plant, East St. Louis. It is Direct-fired by One Low-flame Burner Firing Vertically Downward

One interesting feature of this furnace is the absence of seals. The furnace pressure in the three zones is automatically controlled, and there is no apparent leakage of air into the furnace nor any outward flow of gases, either at the full fired rate or when the temperature is being held constant.

Shell- and Cartridge-Case Furnaces

In the heat-treating of cartridge or shell cases used in anti-aircraft or aircraft ammunition, there are a number of furnaces of different types and sizes used for annealing operations. Starting with the blank or cup, the piece is subjected to a series of draws, and finally to a nose tapering operation, which forms the finished case. On one type of 37-millimeter shell case, there are four annealing operations before the piece is ready for tapering. Then there are two heat-treatments in a liquid furnace to permit tapering and mouth annealing, and finally a low temperature stress relief. The pieces are usually water-quenched after each anneal, and this can either be performed in a continuous furnace equipped for this operation or in an outside quench tank in baskets or some other sort of containers.

The types of furnaces used for heat-treating cartridge cases include conveyor chain, conveyor flight, pusher, batch—vertical or horizontal—and salt bath for tapering.

One of the furnace units designed for heat-treating 0.30-caliber and 0.50-caliber cases has the following specifications: The furnace is about 27 feet long and 8 feet wide. It is designed to operate in a temperature range of from 750 to 1400 degrees F., and has a capacity of 4500 pounds per hour. It is direct-fired with low-pressure burners over and under the work, and there are two control zones. This type of furnace, except for the small charging slot, is completely air- and gas-tight. There are several ways of sealing the charging slot, and it can be seen from this that the design lends itself readily to atmosphere control. Thus, the same furnace, built for higher temperatures, is an excellent unit for hardening the smaller sizes of anti-aircraft projectiles, ranging from about 37 millimeters down to 0.50-caliber bullets. Instead of direct firing, radiant tubes are incorporated over and under the work. An atmosphere gas to insure clean hardening and prevent decarburization is also utilized.

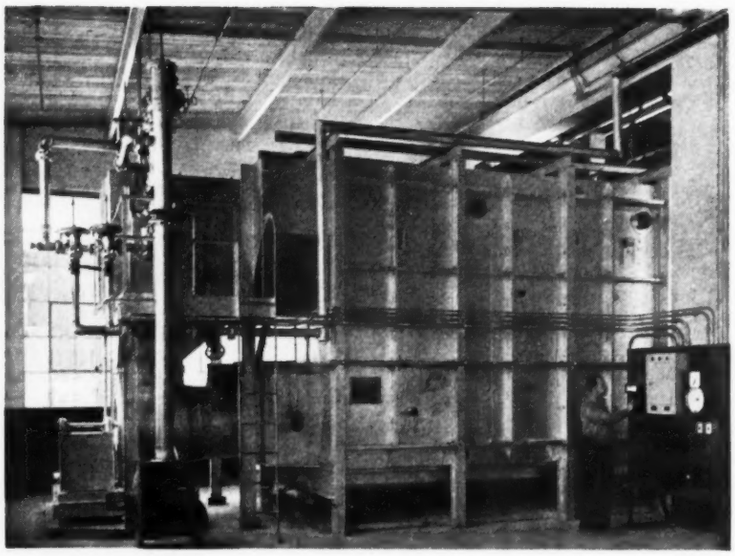


Fig. 4. Another View of Car-bottom Furnace Shown in Fig. 3, which is Heated by Means of Forced Convection. This Furnace is Installed in the Plant of the York Safe & Lock Co., and is Used for Stress-relieving Welded Gun Mounts

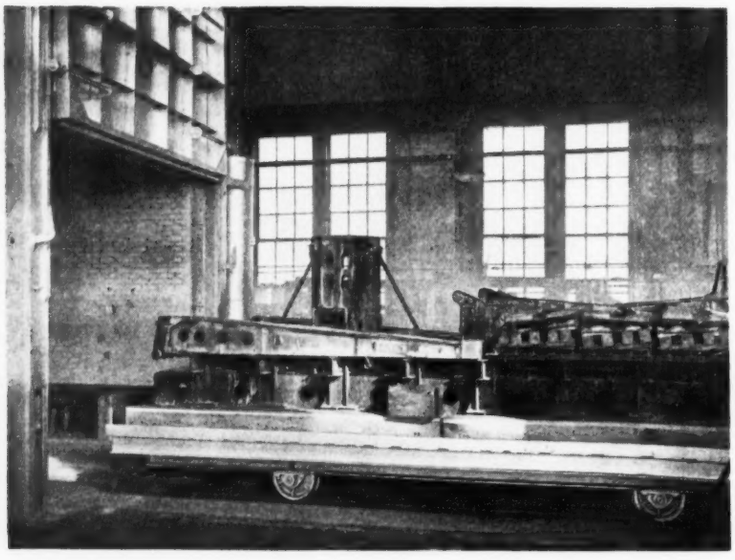


Fig. 3. Loaded Car Ready to Enter Stress-relieving Furnace. Note the Return Duct with Circular Openings Located under the Cross-beams Supporting the Work. This Duct Connects with an Opening in the Rear Furnace Wall

Gun-Barrel Furnaces

For the production of gun barrels for anti-aircraft armament, the following types of furnaces are suitable: Forging furnace, generally of the in-and-out batch type, but may be of the continuous type where sufficient production is demanded; quenching furnaces, preferably of the vertical pit type; draw furnaces, of the vertical or pit type, or of the direct-fired or convection car type; and stress relieving furnaces, of the vertical or pit type or the car type, preferably with convection arrangement.

A typical heat-treating set-up for gun barrels may be described as follows, without going into details as to

temperatures, cycles, etc.: The gun barrels for anti-aircraft guns from 3- to 5-inch caliber are forged from blanks and rough-machined before the quenching operation. The quenching furnace is a vertical pit type unit from 25 to 30 feet deep and about 9 feet in inside diameter. The gun barrels, singly or in groups of two, three, or four, are hung from a special fitting or spider. This is handled with the furnace cover or separately, as desired. The furnace is direct-fired with either high- or low-pressure burners which are applied to insure the most uniform heat input and distribution. There are at least three, and preferably four, vertical zones of control.

After quenching, the gun barrels are lowered into a draw furnace, usually of the pit type, and in some instances, the same furnace is used both for drawing and quenching. While this can be done, it should be pointed out that, at the usual draw temperatures, a direct-fired unit is not so efficient as the convection type, nor can the same uniformity of temperature be maintained.

After the drawing and finish-machining, the gun barrels are stress-relieved in a low-temperature convection furnace. This is usually a car type or horizontal batch type furnace in which the gun barrels may be supported horizontally without fear of bending.

Furnaces for Gun Mounts, Carriages, and Bases

Anti-aircraft gun mounts, gun carriages, bases, and similar equipment are nearly all built up of shapes, plates, and structural members, and are completely welded wherever possible. All of these assemblies have to be stress-relieved. The design and size of the furnace, of course, depend on the nature of the piece. The following types are used for this purpose: Pit type, or vertical, car-bottom and horizontal batch (in-and-out).

Furnaces for these heat-treating operations are usually convection-heated units. The smallest convection furnace built by the Surface Combustion Corporation will take a basket about 12 by 16 inches. The largest built by the company is, roughly, 50 by 50 by 30 feet high, and will handle a welded construction weighing over 300 gross tons. During the soaking period, the temperature distribution is plus or minus 5 degrees F. throughout the loads. In between these two extremes have been built a large number of sizes and types of furnaces for temperatures ranging from 600 to 1250 degrees F., and even higher.

One typical car type convection furnace for heat-treating anti-aircraft gun mounts and carriage assemblies has an effective loading space 17 feet long, 10 feet wide, and 6 feet high. The outside dimensions of this furnace are 28 feet long, 13 feet wide, and 13 feet high. The unit is designed to heat at the rate of 5000 pounds an hour from cold to 1100 degrees F., and it can easily be adapted for a maximum temperature of 1250 to 1300 degrees F. A charge of 10,000 pounds can be brought to temperature in two hours if the specifications permit. Two supply ducts with adjustable louvers are hung under the roof. As shown in Fig. 3, two return ducts are built on the car under the cross-beams supporting the work. These ducts telescope into openings in the rear wall of the furnace.

The recirculating fan at the back of the furnace shown in Fig. 4 takes its suction from the ducts on the car and forces the hot gases through an overhead gas-fired heater into the supply ducts under the furnace roof. The louvers, which can be adjusted from outside the furnace, permit a uniform distribution of heat down through the work. The temperature variation in this type of furnace is, of course, dependent on the fan capacity, but all stress relieving specifications can be easily met by proper engineering analysis.

* * *

Chain Belt Co. Celebrates Fiftieth Anniversary

On September 9, the Chain Belt Co., Milwaukee, Wis., rounded out fifty years of engineering and manufacturing progress. The company was founded in 1891 for producing an improved type of detachable chain then used largely on agricultural machinery. The business was started in a small way, but began to grow immediately. Today, the company has plants in Milwaukee and West Milwaukee, Wis., and in Springfield and Worcester, Mass. To its first product, chain belts, the company added other lines of equipment. In 1908, its first concrete mixer was built. The Rex steel chain belt was introduced in 1910. In 1932, the company began to produce chain belts made from a metal known as Z-Metal, which has the physical properties of steel, but retains the shock-resisting qualities of malleable iron. In 1939, the Baldwin-Duckworth Chain Corporation was merged with the Chain Belt Co. to add finished roller chain belts and automotive timing chain belts to the line. The Baldwin-Duckworth organization is even older than the Chain Belt Co., one division of this unit having been founded in 1871.

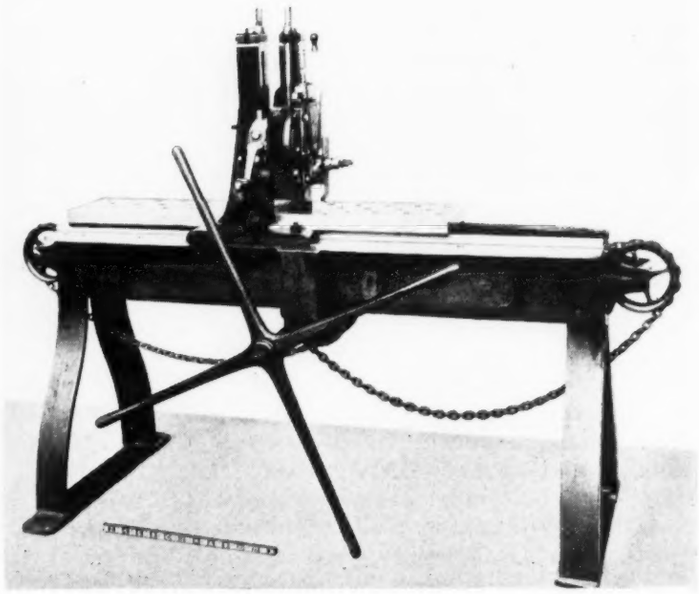
* * *

Railroads are Preparing for Record Freight Movements

On August 1, the railroads of the United States had almost 90,000 new freight cars on order, compared with less than 20,000 a year ago. On August 1, this year, the railroads also had over 600 locomotives on order, about one-half steam engines and the other half electric and Diesel engines. A year ago, the total number of locomotives on order was 168. In the first seven months of this year, the railroads have put in service 323 new locomotives and 43,000 new freight cars.

Historical Notes on Planer Drives

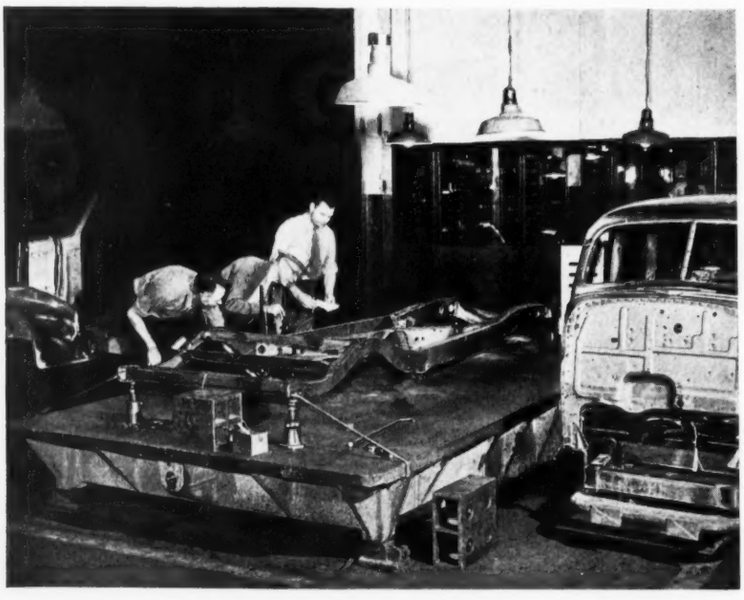
THE earliest known planer drive, according to John E. Doran of the G. A. Gray Co., Cincinnati, Ohio, who some time ago collected some information on this subject, consisted of a chain passing over sprockets at each end of the planer, which was hand-operated by means of a large capstan or handwheel. This machine was built by Richard Roberts in England, in 1817. It is still in existence, and is included in the collection of the South Kensington Science Museum in London. The chain drive was replaced by various forms of geared drives when the steam engine came into general use about 1840 and later.



The Last Word in Planer Design in 1817. This Planer is Now in the Kensington Museum in London. Note the Hand-operated Chain Drive for the Table

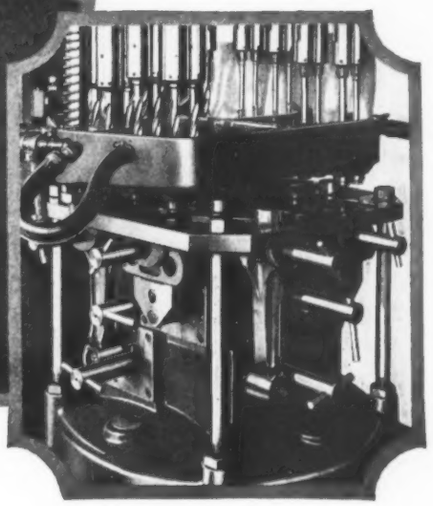
The first application of individual electric motors to planers was in the nineties, the first electric motor drive circular issued by the G. A. Gray Co. having been published in 1893. The motors were sold and guaranteed for one year by the planer builder. It is of interest to note today the horsepower of the motor furnished for various sizes of planers. The smallest planer, which was capable of handling work 22 inches square of "any desired length," had a 2 1/2-H.P. motor. This is less power than is used for the present-day cross-rail motor. Extremely heavy-duty planers, such as frog and switch planers, were equipped with 18-H.P. motors. Today's frog and switch planer frequently takes a 75-H.P. motor, and never less than 50 H.P.

At the Pan-American Exposition in 1901, the same company exhibited a new planer with a "self-contained motor drive." In 1908, the Electro Dynamic Co., Bayonne, N. J., built a satisfactory reversing planer motor, and in 1912 the G. A. Gray Co. installed, in its own plant, a planer with a reversing motor drive, the motor having been built by the Triumph Electric & Mfg. Co., and the controller by the Monitor Controller Co. This installation proved that reversing motor drives could be satisfactorily operated. From that time on, the development in planer drives has been very rapid.



An 18- by 8-foot Steel Surface Plate Used for Many Purposes in the Pontiac Shops. By the Use of This Plate, Possible Errors are Discovered and Corrected Long before They would Otherwise be Noted. Full-sized Chassis, Bodies, and even Completed Cars can be Accurately Checked on This Huge Surface Plate for Interferences and Inaccuracies. The Plate is Level within 0.005 Inch over its Full Length and Width. By This Plate, for Example, the Entire Steering Gear Assembly can be Checked as to Front Camber, Toe-in, Wheel Alignment, and Road Clearance

Design of Tools and Fixtures



Babbitting Fixture for Piston-Rods and Caps

By JOHN W. GERDEL, St. Louis, Mo.

The fixture shown in the accompanying illustration was designed for use in babbitting automobile piston-rods and their caps. One of the caps is shown clamped in position for babbitting at *A* in section *Y–Y*. The babbitting of a piston-rod (not shown) is accomplished by the same methods as are employed in babbitting the cap. Fixtures like the one shown have been made in several sizes to accommodate different caps, all being designed to permit quick changing of the caps in order to meet production requirements. Two noteworthy features are the method employed for clamping the cap against angle-plate *B*, and the method of clamping slides *O* and *D* against the top and bottom of the cap.

The cap is clamped against the angle-plate by two threaded and shouldered studs *E* which are recessed under the outer shoulder. These studs are so located, through holes in the angle-plate, that when cap *A* is placed on pins *F* (section *Y–Y*), the stud heads overlap the edges of the cap and obtain a good clamping grip. Handle *G* is in an upright position when the caps are placed on the locating pins. This handle is a continuation of lever *H* which is pivoted on a pin in a forked casting that is secured to the horizontal part of the angle-plate *B*.

A pin *J* is so located in lever *H* that when handle *G* is in the clamping position, it will exert a pull on the ends of levers *K*, which are hinged on one end to a cross-piece *L* (section *Y–Y*). Cross-piece *L* pulls against springs until the other ends of levers *K* are carried past the center line *Y–Y* shown in the side view in the lower right-hand corner of the illustration. This causes the whole clamping unit to remain in tension.

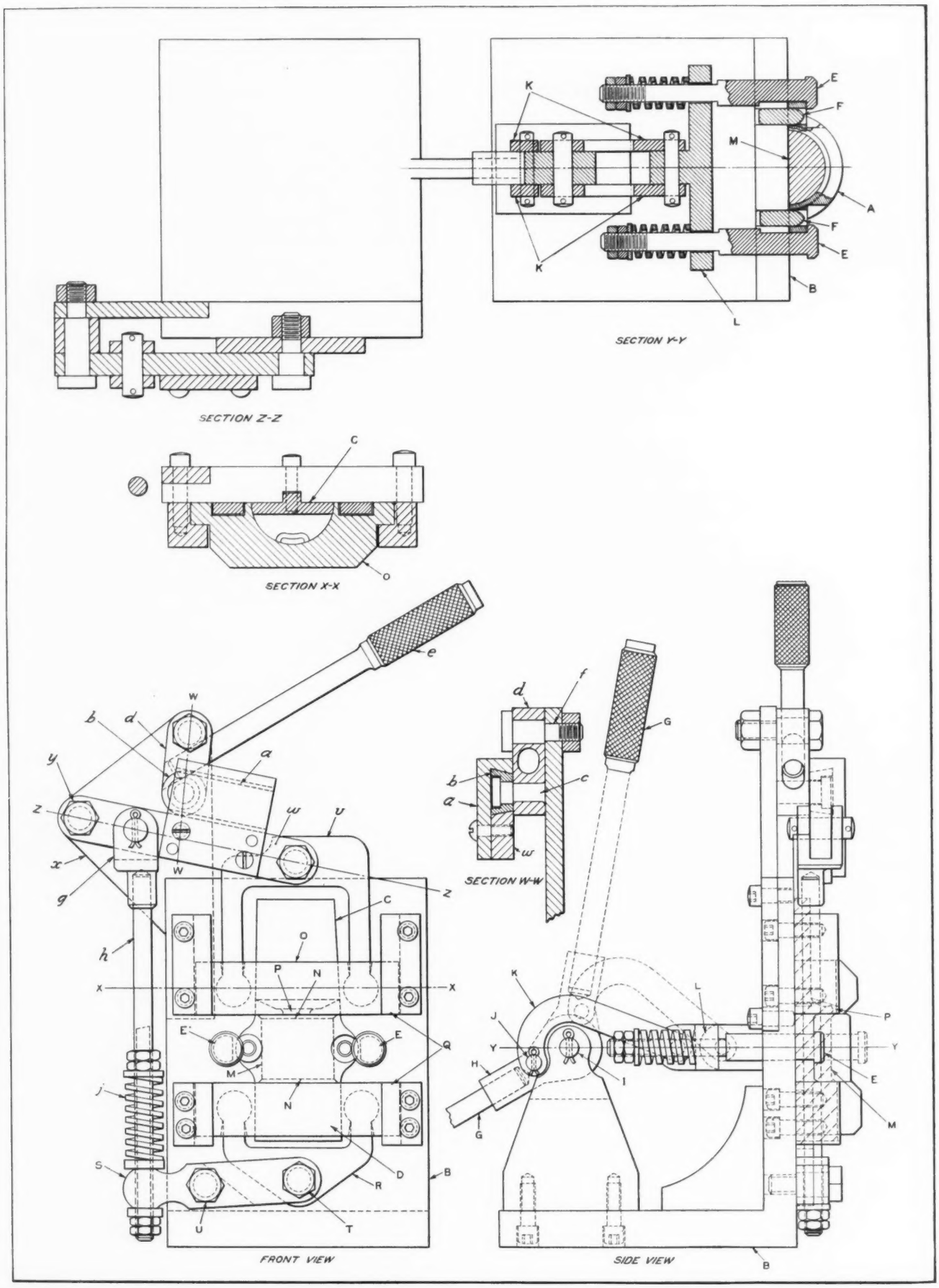
The springs are held on studs *E* by means of a washer and two check-nuts. The springs are provided because the thickness of the caps varies, and also because of the method of clamping, which causes levers *K* to be pulled past the central position. As handle *G* continues to descend, the tension is slightly relieved, permitting the springs to exert enough pressure to keep the caps tightly clamped against the face of the angle-plate. The check-nuts permit making adjustments to compensate for wear and to take up slack caused by any weakening of the springs resulting from the heated condition under which the fixture is required to operate.

A core *M* is fastened on the front of angle-plate *B*, the part of the core that forms the babbitt being turned to a suitable diameter for the kind of caps to be handled. A chamfer or radius, depending on the kind of motor for which the caps are intended, is also formed at *N* by the core.

In producing the core for the fixture, the casting for this member was made to extend past the center. This permitted it to be centered and turned in the regular manner. Afterward, the surplus stock was removed, but a rib (section *X–X*) was left on the back side. This rib was fitted into a slot milled in the angle-plate, so that two screws serve to hold it in place.

The upper part *C* of core *M* is tapered, and a large part of it is planed off, as shown in section *X–X*. The bore of upper slide *O* is tapered to suit the taper of the core, and is of such a size that when the slide is in the clamping position, the bore fits snugly on the core. The flat on the upper part *C* of the core and the bore of slide *O* form a sprue cavity into which the hot babbitt is poured. The tapered bore of slide *O* permits it to be raised easily when the babbitt solidifies.

Gate *P* was made as shown in the front and side views to facilitate knocking off the sprue. The bottom part of the core was turned parallel. The bore



Fixture for Babbitting Piston-rod Cap A, Employing Core M to Mold Babbitt; Clamping Studs E, Actuated by Lever G, to Hold Cap in Place; and Slides O and D Clamped against Top and Bottom of Cap by Lever e

of bottom slide *D* was tapered slightly toward the bottom to permit it to rock in order to take care of variations in the cap dimensions, the sides of the cap sometimes being out of square with the face. Upper slide *O* was also tapered slightly in the same way.

Guide blocks *Q* for the slides were made of cast iron, and were so machined that they were a loose fit on the slides, except when they were in the shut position. This was done to compensate for any lack of parallelism in the sides of the cap. Bottom slide *D* is actuated by the forked lever *R* connected to a pivoted lever *S*, to which it is fastened by shoulder-screw *T*. Lever *S* is pivoted on shoulder-screw *U*, which is screwed in the angle-plate casting. Upper slide *O* is actuated by another forked lever *v* connected to lever *w* by a shoulder-screw. Lever *w* is anchored on plate *x* by means of shoulder-screw *y*. Plate *x* is fastened on the back of the angle-plate.

On lever *w* is fastened an angle-piece *a* (section *W–W*) in such a manner that a slot is formed in which a hardened-steel roller *b* travels. Shouldered stud *c*, on which steel roller *b* rolls, is riveted in lever *d* to which is fastened knurled handle *e*. Lever *d* is secured to the top of plate *x* by means of shoulder-screw *f*.

A shackle *g* is fastened to lever *w* by means of a pin. A long stud *h*, secured to shackle *g*, actuates lever *S*. Stud *h* is connected to lever *S* by means of check-nuts, washers, and a spring *j*. The spring provides for variation in the widths of the caps.

The caps are located on the angle-plate by means of pins *F*, shown in section *Y–Y*. The front view shows the device in the closed position. In operation, handle *G* is pulled up all the way. After the caps have been placed on pins *F*, handle *G* is pushed to the lower position. This causes studs *E* to clamp the caps against the face of the angle-plate. Handle *e* is then thrown to the right, causing slides *O* and *D* to be clamped against the top and bottom of the cap. Forcing handle *e* all the way to the right causes steel roller *b* to travel past the center line, where it will stay locked in position. The slides *O* and *D* are then tapped with a lead mallet in order to make sure that they are properly seated. The babbitt is now poured into the sprue until it is almost full. In no case should it be allowed to overflow, as this might cause slide *O* to become stuck or jammed.

After the babbitt has hardened, handle *e* is thrown to the left, causing the lower slide *D* to fall away from the bottom of the cap and upper slide *O* to be lifted clear of the sprue. Handle *G* is then lifted to the upper position which causes studs *E* to knock the caps off the locating pins by means of an inner shoulder, thus making the fixture ready for reloading. It should be noted that levers *K* and *d* are located past the center lines when they have reached the end of their travel. This is important, as otherwise, these members would not stay in position.

Drilling Fixture Designed to Reduce Lay-Out Costs

By JOSEPH WAITKUS, Wellsville, N. Y.

Lay-out work is often the most expensive operation in producing a machined part, the accuracy generally required necessitating special care, which frequently consumes considerable time. Therefore, reducing the amount of lay-out work results in cutting down costs, and may also result in a greater degree of uniformity in the product. The latter is especially true where there is a duplication of the lay-out work and where some form of templet or guide can be provided, as in the case of the fixture shown in Fig. 1.

It was necessary to provide a number of groups of holes around the periphery of a wheel rim. Each group, as shown in Fig. 2, consists of a single center hole, with four slotted holes distributed in a definite pattern around it. The slotted holes are located on two separate radii, two slotted holes for each radius, and are made by drilling a series of round holes, which are then carefully filed to the desired shape. The manner in which the slotted holes were drilled is indicated in Fig. 3, which shows the small amount of material left to be removed by filing at points *S*.

The fixture is supported on base *A*. The wheel to be drilled has a large bore to which a center plate *B* is fitted and fastened by bolts *C*. The center plate and wheel are supported on a stud *D*. A nut *E* and thrust washer *F* are provided for locking the wheel in the various drilling positions.

The fixture is equipped with an adjustable drill-jig plate to accommodate a variety of wheel sizes. Slotted holes in base *A* permit jig-plate retainer *G* to be adjusted and clamped at any desired height by bolts *H*. Retainer *G* is split to permit clamping jig plate *J* securely when nut *K* is tightened.

Jig plate *J* is provided with three drill bushings *L*, *M*, and *N*, Fig. 4. Bushing *M* is for use in drilling the center hole of the group of holes. Bushings *L* and *N* are spaced at each side of center bushing *M* in accordance with the radius dimensions of the slotted holes for which each is used.

The routine followed in drilling each group of holes is quite simple. The wheel is first divided off into the number of groups of holes desired and a center line is scribed across the full face of the wheel rim to indicate the location of the center of each group. After placing the wheel on stud *D*, the operator positions the scribed mark by sighting it through the slot at *T*, Fig. 1, in the split side of jig-plate retainer *G*. This places the scribed mark directly under bushing *M*, after which holding nut *E* is tightened. The center hole is then drilled through bushing *M*, and pin *O* inserted to prevent the wheel from moving.

As previously mentioned, the slotted holes were first drilled as a series of adjoining round holes. In order to accomplish this without laying out each

hole on the wheel, jig plate *J* is provided with a series of division marks along its outer edge in contact with retainer *G*. A single mark is provided on retainer *G*, so that by rotating the jig plate the division marks can be lined up. Pins *P* in jig plate *J* furnish a means of rotating the plate.

It will be noted that there are three marks for each group of divisions on jig plate *J*. The two outer marks are for the outermost ends of the slotted hole; the middle mark serves to place the drill bushing in position for the removal of the metal between the two holes. The two outer holes are drilled first, after which the middle hole is drilled. The groups of division marks are numbered 1 and 2 corresponding to drill bushings *N* and *L*, respectively. In other words, when placing the series of division marks of 1 in line with the mark on jig-plate retainer *G*, drill bushing *N* (also marked 1) is used for the drilling operation.

With this fixture, the only lay-out work required is the scribing of the center lines on the face of the wheel for locating each group of holes. Separate jig plates with the proper division marks can be made for any combination of holes.

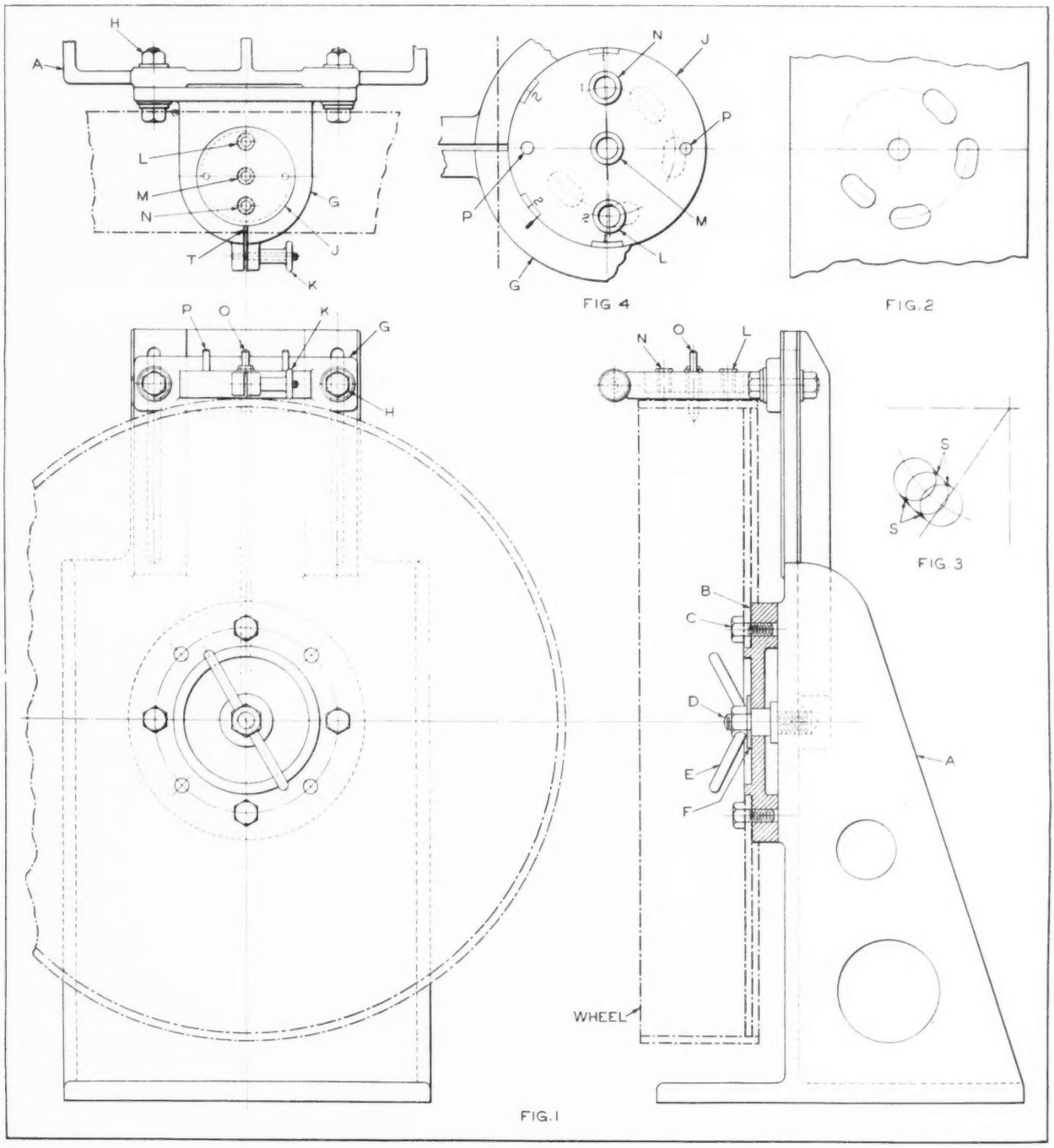


Fig. 1. Fixture Designed for Drilling Groups of Holes in Rim of Wheel. Fig. 2. One of Several Groups of Holes Drilled in Rim of Wheel. Fig. 3. Enlarged-scale Lay-out of Three Holes Drilled to Produce Slotted Holes Shown in Fig. 2. Fig. 4. Indexing Jig Plate for Drilling Central Hole and Holes for Slots

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Refractory Ceramic Material	**Alsimag 222**	Machinable, ceramic material with low dielectric loss at high frequencies which can be used at temperatures up to 2500 degrees F. Available in round or tubular form and in disks or plates; special shapes also can be supplied. Because of abrasive nature, must be machined with carbide tipped tools.	Especially suitable for building working models. Also suitable for application in electronic field.
Protective Coating	**Amercoat**	A liquid plastic coating for brushing or spraying on metal or concrete surfaces. It is odorless, tasteless, and chemically inert. Will not check, crack, or fracture when subjected to vibration, and also resists abrasion. Usually applied in three coats.	Suitable for use where resistance to salt water, cold mineral acids, alkalies, oils, fats, gasoline, mineral salts, and alcohol is required. Not suitable for use when subjected to certain acids in concentrated form, aldehydes, benzine, carbon disulphide, and ether.
Malleable Iron	**Belectromal**	A malleable iron which has high strength without sacrificing the ductility and machinability usually associated with this type of iron.	Intended for parts requiring greater strength than ordinary malleable iron, but having comparable ability to withstand shock and to machine readily.
Bearing Babbitt	**Bermax**	An improved high-lead babbitt that is not subject to oil corrosion. It has a melting point slightly higher than that of tin-base bearing alloys, and can be cast by any method without fear of segregation. Maximum permissible unit pressure, 1800 pounds per square inch.	Particularly recommended for rebabbitting steel-back or bronze-back bearings or housings of cast steel or cast bronze. Suitable for a wide range of applications in the automotive, Diesel engine, pump, and compressor fields.
High-temperature Lubricant	**Caloria**	A high-temperature lubricant that gradually vaporizes when used, and leaves no residue. Also available with small amounts of colloidal graphite added.	For use wherever difficulties are experienced with high-temperature lubrication, due to deposits of carbon and "varnish" remaining after evaporation of the lubricant.
Bearing Material	**Carobronze**	A bearing material having ability to carry heavy loads at high speeds. Contains 91.2 per cent copper; 8.5 per cent tin; and 0.3 per cent phosphorus.	It is available in tubular form, wire, rods, and bars, and sheet and strip. Shorter, thinner-walled bushings are made possible by this material.
Welding Alloys	**Castolin**	A series of eutectic welding alloys that, because of their low melting point, afford rapidity of operation, freedom from warpage due to high temperatures, and protection against detrimental structural changes in the base metal. The eutectic alloy rod melts and fuses with the base metal, which is heated but not molten, the bond being accomplished by capillary action.	Applicable for joining a wide range of metals; for low-temperature color-matching welds on cast iron; welding of delicate and intricate castings; low-temperature brazing of steel, malleable cast iron, tungsten carbide, and aluminum; and joining of copper and nonferrous metals to aluminum.
Armor Plate	**Colalloy Armorplate**	This armor plate weighs 50 per cent less than steel, and has a much greater surface hardness than ordinary armor plate. Its highly polished surface resists corrosion.	Designed for use in the construction of propellers, wings, fuselages, struts, gas tanks, and other parts for military airplanes.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Atomic-welding Material	**Colaweld**	A liquid, paste, and rod for the atomic welding of metals without the use of welding apparatus. Not intended as a substitute for welding by regular methods, but for work heretofore difficult or impossible to accomplish by ordinary welding methods.	The paste and rod are intended for practically all non-ferrous materials, including aluminum; the liquid and rod for stainless and low-carbon steels and practically all ferrous alloys. Metal from 0.005 to 0.050 inch in thickness can be welded.
Metal Coating	**Colaweld Mormetal**	A coating material that can be applied with a spray, brush, or as a powder and then heated by oven, torch, or other means to produce a fusion bond. High resistance to corrosion, abrasion, and erosion is provided.	Zinc, cadmium, tin, bismuth, lead, and their alloys can be applied to ferrous and non-ferrous metals by this process. Useful for high-speed production in the fields of marine construction, transportation, building and general maintenance.
Hard-surfacing Alloy	**Colmonoy No. 4**	A hard-surfacing alloy that has a hardness of 35 to 40 Rockwell C and can be machined without great difficulty. It is applicable to cast iron.	Suitable for application to forming and drawing dies and parts subjected to abrasion.
Hard-surfacing Alloy	**Colmonoy No. 5**	A hard-surfacing alloy that has a hardness of 45 to 50 Rockwell C and provides good wear resistance and freedom from galling, combined with moderate machinability.	Suitable for high-temperature steam valve trim and solid shaft bearing surfaces.
Hard-surfacing Alloy	**Colmonoy No. 6**	A hard-surfacing alloy that has a hardness of 55 to 60 Rockwell C, with high abrasion resistance and high compression strength.	Used extensively on parts having very small wear tolerances, and in cases where heavy pressures are encountered.
Galvanized Sheet	**Colorbond**	A galvanized sheet with a special surface finish which is more resistant to rust and provides a better bond for paints, lacquers, varnishes, etc., than the usual finish.	Available in three types of base metal: Steel, copper-steel, and pure iron-copper alloy, in a full range of sizes and gages.
Packing Material	**Corroflex**	A waterproof packing material consisting of a flexible, corrugated packing with criss-cross indentations, together with a duplex asphalt-lined sheet.	Useful in protecting metal parts and products against rain, hail, snow, or moisture.
Plating of Steel	**Corronizing**	An electrolytic process for applying alternate layers of nickel and tin to steel sheets.	Suitable wherever tin plating alone has been required. Effects considerable saving in tin.
Stainless-steel-clad Plate	**Croloy**	A carbon-molybdenum steel with thin sheets of chromium stainless steel welded to it. Can be hot-formed, spun, or welded as easily as unbonded plate.	Useful where strength, as well as resistance to corrosion, is required.
High-temperature Alloy Steel	**Croloy 7**	Analysis: Carbon, 0.15 per cent max.; manganese, 0.50 per cent max.; phosphorus 0.030 per cent max.; sulphur 0.030 per cent max.; silicon 0.50 to 1.00 per cent; chromium 6.50 to 7.50 per cent; and molybdenum 0.45 to 0.65 per cent. Offers considerable resistance to corrosion and oxidation.	Suitable for high-temperature applications, such as oil refinery cracking-still tubes and steam superheaters.
Copper-iron Alloy	**Cuferco**	This material has an electrical conductivity about 70 per cent that of copper, and a tensile strength about equal to hot-rolled, low-carbon machinery steel. It has a tensile endurance limit 23 per cent higher than that of Cupaloy.	Particularly suitable for tips for spot welders, since it can be hardened by heat-treating and is softened very little by repeated applications of heat.
Phenolic Molding Compound	**Durez 775**	A general-purpose phenolic molding compound with excellent molding characteristics and a fast cure; will provide a smoother and more lustrous finish than the average general-purpose material.	As compared with other general-purpose compounds, it has lower water absorption, slightly higher flexural and tensile strength, and a heat resistance of 400 degrees F.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
High-impact Plastic	Durez 1900 Black	A high-impact phenolic molded material, easily preformed and readily fed through hoppers and automatic feeding devices.	Suitable for production of molded parts that may be subjected to shock.
Molding Compound	Durez 1910	Third in a series of high-impact phenolic molding compounds. It preforms easily, and flows readily through standard feeders, as particle size is comparable to dry rice. Has a specific gravity of 1.45 and a bulk factor of 3.6 to 1.	Developed especially for such applications as bumper shoes, refrigerator lock-bolts, and other parts where minimum frictional resistance is desirable.
Phenolic Plastic Impregnant	Durez 7347A	A phenolic resin applicable to porous castings. Impregnation is accomplished under air pressure and is followed by baking with or without steam pressure. A smooth surface is formed that is practically impervious to water, solvents, mild alkalies, and acids.	For impregnation of porous castings that do not quite hold required pressure or where a smooth impervious surface is required.
Phenolic Molding Compound	Durez 8685	A material having high resistance to carbonization under an electric arc and that will hold its high dielectric strength when used at moderately high temperatures. It does not crack under expansion and contraction of metal inserts.	Developed especially to prevent "tracking" in cases where there is combined electric spark and rubbing action.
Blackening Process for Zinc	Ebonol Z	An immersion process for blackening zinc and its alloys. Immersion in a solution of the salts at 150 to 212 degrees F. results in a jet-black inorganic finish in from one to five minutes. Also can be used to produce black coatings on stainless steel, nickel silver, nickel, and the noble metals.	Can be utilized for blackening zinc-plated or hot-galvanized surfaces, as well as solid zinc and its alloys. Also applicable to nameplate finishing and blackening of etchings on rules, squares, tools, etc.
Metal-blackening Process	Electro-Ebonol	A process for the electrolytic blackening of almost all metals. Deposits are made in from 30 seconds to 3 minutes at 140 to 190 degrees F.	Aluminum, steel, stainless steel, zinc, cadmium, nickel, silver, gold, lead, tin, and various alloys can be blackened by this process.
Spring Wire	Electromatic	An oil-tempered spring wire of uniform physical properties and closely controlled fatigue values.	Suitable for a wide range of uses, such as brake springs, clutch springs, airplane construction, farm machinery springs, etc.
Tinning Flux	Fas-Tin-Flux	A concentrated liquid tinning flux of the zinc-chloride type. Has special addition agents to assure fast action, and is free from uncombined hydrochloric acid. Can be poured on molten tin without danger of explosion.	For use in hot-tinning, in the manufacture of terne plate (lead-tin alloy), and for soldering.
Protective Coating	Flexo Wax C and Diglycol Stearate S	An emulsion of these two products in combination with paraffin wax produces a water-repellent wax coating that protects metal.	For aluminum castings liable to attack by water condensation. Suitable on extruded parts and on zinc- and tin-plated products.
Packing Lubricant	Formula No. 610725	A compound that provides durable lubrication and makes an effective seal, with assurance against possible scoring. It forms an actual metallic surface, which quickly attains a polish or glaze when in contact with a moving member. Suitable for all pressures and for temperatures up to 1000 degrees F.	Intended for application to exterior surfaces of all types of packing prior to installation, and to stuffing-boxes after installation.
Powdered-metal Contacts	Gibsiloy	Eight grades of nickel-silver, silver-nickel-tungsten, silver-nickel-molybdenum and silver-nickel-cadmium powdered-metal compositions which can be produced in button, wire, strip, or rod form.	Can be headed into rivets or buttons for electrical contacts or coined to any shape required.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Sealing Compound	**Glycoseal**	A flexible, leakproof, and non-cracking compound that can be used on rubber as well as on metals. As it will not harden, joints once formed can be broken readily without damage to fittings.	Useful as a sealing compound for joints in pipes and containers carrying propane, pentane, butene, benzol, naphtha, gasoline, grease, and oils of all types.
Ferro Alloys	**Grainal**	These alloys are used to produce desirable properties in steel. One contains 25 per cent vanadium, 15 per cent titanium, and 10 per cent aluminum; another contains 13 per cent vanadium, 20 per cent titanium, and 12 per cent aluminum; while a third contains 20 per cent titanium, 20 per cent aluminum, and 6 per cent **zirconium.**	They make possible the production of steel of uniform properties from heat to heat; the conversion of some water-hardening steels into oil-hardening; the production of steel of unusual physical properties at economical cost; and the addition of alloys to steel without complicating the usual steel making processes.
Ornamental Metal Finish	**Hammertone**	Finishes resembling hammered silver, copper, bronze, and other ornamental metals are obtained by this liquid finish. A base coat of desired color is followed by a spatter coat of Hammertone liquid.	Can be applied to any kind of metal, and also to molded plastics. The finish is tough and durable.
Self-lubricating Alloy	**Hancodur**	A self-lubricating alloy with excellent wearing qualities. Its tensile strength is 90,000 pounds per square inch.	Designed to be used for valve stems and bonnets.
Welding Rod	**Haynes 93**	An alloying rod for hard-surfacing wearing parts. It has a tensile strength of about 43,000 pounds per square inch and a hardness (as deposited by oxy-acetylene welding) of 62 Rockwell C. When properly heat-treated, the hardness may be increased to 66 or 67 Rockwell C.	Successfully used on dredge pump impellers, cement-clinker crusher rolls, tamper feet for cinder block manufacturing, tube-bending mandrels, farm implements, and other parts where severe abrasion and moderate impact are encountered.
Steel	**Hipersil**	A silicon steel of high permeability. Its flux-carrying capacity is one-third greater than that of ordinary silicon steel.	Particularly applicable to transformer core construction. Its use permits reductions in size and weight up to 25 per cent.
Alloy Cast Iron	**Hi-Tensilloy**	A chromium-molybdenum cast iron suitable for forming and drawing dies. Is readily flame-hardened with air-cooling. When flame-hardened (without a water quench), it has a surface hardness of 450 to 600 Brinell, with case depths up to 3/32 inch. When wear occurs, dies can be renewed by flame-annealing, machining, respotting, and hardening.	Used for automobile-fender draw dies and automobile radiator-grille dies. Useful where volume of production is large.
Non-magnetic Steel	**Jessop Non-Magnetic Steel**	A free-machining alloy steel having a magnetic permeability of from 1.003 to 1.006 at 1000 oersteds magnetizing force at temperatures from sub-zero to boiling. Tensile strength, from 80,000 to 110,000 pounds per square inch; yield point, 35,000 to 60,000 pounds per square inch; elongation in 2 inches, 25 to 50 per cent.	Suitable for use in transformer, switch, and controller covers, entrance plates, spacing bars, end fingers, and numerous other parts of electrical equipment.
Protective Coating	**Jetal**	This is an improvement of a former process. Two-bath system produces a deeper black coating with simpler manipulation and control of solution.	Provides a black corrosion- and rust-resistant finish to steel.
Enamels for Plastics	**Kem Bakolescent** **Kem Plastite**	An enamel applicable to plastic surfaces. Available in iridescent form (Kem Bakolescent) or in solid colors (Kem Plastite). Applied by either dipping or spraying.	Useful in dressing up molded parts for vacuum cleaners, electrical wiring devices, radio cabinets, automobile parts, etc.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Machine Tool Finish	**Kem Machine Tool Enamel**	A faster drying synthetic enamel which provides greatly increased resistance to cutting compounds.	Intended specifically for machine tool castings.
Protective Coating	**Koroplate**	A grade of Koroseal paint for use under highly corrosive conditions. The base of this paint is a synthetic material developed from polyvinyl chloride. It can be brushed or sprayed at ordinary room temperatures. Available only in semi-glossy black.	Resists all acids except concentrated formic and acetic acids. Is not affected by brass-, chromium-, nickel-, cadmium-, zinc-, copper-, silver- or tin-plating solutions. Used for coating underground pipe lines and fume ducts in plating rooms.
Transparent Plastic Film	**Koroseal**	A synthetic thermoplastic material, processed into a transparent and highly durable film which is resistant to outside exposure, sun, oxygen, and extreme temperatures, as well as water. It is chemically inert and flame-resistant as well.	Used in laminated containers to hold acids and corrosives, and for insulating fine electric wire and cable. Also used in molded gaskets, grommets, and in acid and weather-resisting paints. Available in a variety of colors and also in translucent and opaque forms.
High-nickel Alloy	**KR Monel**	A high-strength, non-magnetic alloy having satisfactory machining characteristics combined with physical properties similar to K Monel. In hot-rolled form, it has a tensile strength of 90,000 to 120,000 pounds per square inch, with a hardness of 140 to 225 Brinell. In cold-drawn form, these values are higher.	Can be readily fabricated in automatic screw machines. Because of its non-magnetic property, it is particularly suitable in airplane construction. Has corrosion resistance similar to K Monel.
Synthetic Rubber	**Liberty**	A synthetic rubber produced from petroleum, natural gas, air and other natural materials. Does not swell or lose tensile strength when exposed to gasoline or mineral and vegetable oils.	Has proved preferable to natural rubber for gasoline hose and airplane expander tube brakes. Also satisfactory for automobile tires.
Steel Plate	**Manganal**	An austenitic, tough, non-magnetic steel containing 11 to 13 1/2 per cent manganese and 3 1/2 per cent nickel. Can be welded without subsequent quenching. Has a tensile strength of 140,000 to 150,000 pounds per square inch, an elongation in 2 inches of 72 1/2 per cent, and a reduction in area of 54 per cent.	Useful in electrical applications where non-magnetic characteristics are important. Also makes a good substitute for heavy castings where weight reduction is important, as in journal boxes, wear plates, mill liners, shovel buckets, crusher hammers, etc.
Metal Coating	**Marlox**	A plastic coating for metals that has a high degree of adhesion and is not appreciably affected by temperature changes. Can be applied by spraying, dipping, or brushing.	Used as a priming coat or alone, to protect metals against rust and corrosion. Particularly suitable as a coating for welds to prevent corrosion in seams and folds.
Photographic Material	**Matte Transfer Film**	A photographic material for sensitizing metal plates for the photographic printing of drawings by contact or projection.	Applicable in any field where metal templets are used in laying out operations.
Paste Solder	**Meltomatic**	A paste solder that can be brushed on any metal and heated by any means to its melting temperature, which is slightly above 400 degrees F. No preliminary cleaning or tinning operations are necessary.	Especially applicable where soldering irons are difficult to use, as in inaccessible spaces and on small parts.
Pattern Coating Compound	**Metaline**	Liquid metal compound designed to coat and seal wax fillets and gates preparatory to the use of "Patternseal." Reduces the usual hand-soldering by about 50 per cent when used as a bond between metal plates.	Can be applied as a heavy coating over small pin-holes in metal patterns or around edges for thin fillets; also as a bond between two surfaces, such as between metal hand patterns and metal or wooden plates.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Protective Metal Coating	**Metaseal 494**	A protective, invisible, transparent coating that can be applied by dipping, spraying, or brushing without special equipment.	Useful as a rust-preventive for steel, brass, and other metals.
Stripping Compound	**Metastrip**	A stripping compound, furnished in concentrated liquid form, which removes finished coatings by emulsifying action, leaving a bright clean metal surface. It contains no caustics.	Useful in stripping baked enamels, varnishes, lacquers, paints, japans, and new synthetic finishes from various metals.
Coating Material	**Miccrolac**	A transparent coating material that dries rapidly to a high luster and has excellent adhesion, flexibility, and abrasion resistance. Can be applied by spraying, dipping, or brushing.	Provides excellent protection against the harmful action of sulphur dioxide, sunlight, moisture, oil, grease, gasoline, and chemical fumes.
Bearing Material	**Monarch Metal**	A bearing bronze manufactured in various high-lead combinations. Does not contain hard, abrasive tin and lead oxides. Superior hardness and compression resistance are provided. In cases of lubrication failure, seizing or galling of shafts is avoided.	Adapted to a wide range of bearing and seal applications. Less friction, heat, and noise are claimed to be produced by this material.
Aluminum Alloy	**No. 40**	This is a high-strength aluminum alloy, with a tensile strength of 35,000 to 40,000 pounds per square inch, a Brinell hardness (500 kg.) of 80 to 90, and a modulus of elasticity of 10,700,000.	For structural and decorative uses. Will take a high polish and has good resistance to corrosion.
Aluminum Alloy	**No. 40-E**	This is an aluminum alloy of high ductility. It has a tensile strength of 32,000 to 36,000 pounds per square inch, a Brinell hardness (500 kg.) of 70 to 80, and a modulus of elasticity of 9,020,000.	For structural and decorative uses. Will take a high polish and has good resistance to corrosion.
Light-weight Alloy	**No. 301**	This alloy is 66 per cent lighter than steel or iron; rustproof; non-magnetic; and has good forming, drawing, and electrical conductivity properties. Its ultimate tensile strength is 72,000 pounds per square inch; elongation in 2 inches, 32 per cent; yield point, 57,500 pounds per square inch; and hardness, 109 Brinell. Available in sheet, plate, rod, bar, wire, pipe, tubing, and extruded forms.	This is a readily fabricated structural material which lends itself to gas-welding, arc-welding, spot-welding, brazing, soldering, chemical-fusion welding, and reaction soldering.
Tool Steel	**No. 773**	A medium-carbon manganese-molybdenum steel possessing a high degree of toughness.	Suitable for dies, punches, cutting tools and chisels, step-down dies, etc.
Pulley Covering	**Nonslip**	A sheet material that is wrapped around pulleys to prevent slip. Furnished in sheets of 9 square feet which are cut into strips of proper width.	A single application eliminates belt slippage for a period, usually, of two years.
Protective Coating	**Paratex**	A fast-drying, waterproof covering material made from chlorinated rubber. Unusually resistant to ordinary solvents, such as gasoline, kerosene, and lubricating oil, and also to alkalies, soda ash, and inorganic salts in dust or powder form.	Especially suitable for protecting steel work exposed to salt air. The metal primer also used has a lateral absorption action which turns up loose scale that might form subsequent defects in the covering.
Pattern Coating Compound	**Patternseal**	A coating that forms a protective seal against moisture penetration. It permits patterns to be used without a parting compound. One application usually lasts for a full day's run.	Developed for sealing and coating match plates, core-boxes, etc. Can be applied over shellacked, as well as new, wood surfaces.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Pickling Agent	**Pickleen**	A liquid wetting and penetrating agent which, when added to sulphuric or hydrochloric acid pickling solutions, reduces their surface tension and gives them greater wetting and penetrating action. It is added in the proportion of one pint to about fifty gallons of acid solution. It is non-inflammable, almost odorless, and harmless to the skin.	Used in pickling solutions for cleaning rust or scale; in acid dips before plating to insure clean work and to prevent peeling or blistering; for pickles employed previous to hot-galvanizing, hot-tinning, rust-proofing, painting, etc.
Plastic Shapes	**Plastikmould** **Plastiktrim**	Extruded plastics shapes, manufactured in a wide range of colors and in the form of rods, tubes, and other commercial parts, both flexible and rigid.	Designed for use where aluminum products of similar shapes and sizes have been utilized.
Die Impression Compound	**Plasul** **Basolit**	An impression checking material that is very light, does not shrink, and will show the finest markings of a form or die.	Particularly adapted for checking impressions of forging and die-casting dies. Can be used in place of wood patterns because of dimensional stability.
Metal Finish	**Polymerin-100**	A finish with excellent qualities of corrosion resistance and durability, combined with film hardness, luster, adhesion, toughness, and color retention.	For use where low-temperature, high-speed baking characteristics are important.
Waterproof Paint	**Porce-Tite**	A white waterproof paint that can be used in any consistency from that of a cement-like compound for filling cracks and crevices, to that of a free flowing paint. The paint sets in about three hours, hardens in twenty-four hours, and requires about five days to cure thoroughly.	May be applied to cement, concrete, brick, stucco, clay tile, stone, asbestos sidings, and plaster board, but not to wood, plaster, metal, nor oily surfaces. Paint, calcimine or casein can be applied over it.
Bearing Bronze	**Pre-Cast Bearing Bronze on Steel**	A thin-wall, laminated type of bearing consisting of SAE 64 bronze bonded to steel. Has a higher Brinell hardness, lower coefficient of friction, and greater resistance to pounding and shock than ordinary cast bronze. Also available as a graphited bearing.	Available in plain or graphited form as finished bearings, washers, strips, or in rolls up to 400 feet in length.
Electrical Insulation Porcelain	**Prestite**	A porcelain for electrical insulation having a dielectric strength equal to that of wet-process porcelain, and a mechanical strength about 10 per cent greater under tension and cantilever loads. It is impervious to moisture.	Particularly adaptable for use in intricate shaped pieces; dimensions can be held accurate within 1 1/2 per cent.
Protective Metal Compound	**Protect-O-Metal**	Protective compound, resistant to heat, for use in welding and die-casting. Can be sprayed or brushed on metal. When sprayed on a die-casting die, it serves as a protective coating for at least twenty-five successive castings.	Used to prevent corrosion and the collection of spatter on metal surfaces during welding. Prevents castings from sticking to die molds. Also forms suitable priming coat for paint.
Metal Finish	**Pyroflex**	An inorganic finish having all the features of porcelain enamel, but requiring only one-half the burning time of baked-on enamels. Withstands heat and hard usage.	Available in a wide range of colors and grain finishes for use wherever porcelain enamel is called for.
Belt Coating	**R-60-T**	A synthetic coating which can be brushed on belts of all types. Samples of belting, when so coated and placed under severe tension, have shown no evidence of deterioration after six months' exposure to all kinds of weather.	Particularly useful for protection of outdoor conveyor belting from deterioration through action of sunlight and air, especially during idle periods.
Flexible Tubing	**Resistoflex**	Tubing made in sizes up to and including 1/2 inch inside diameter, from a flexible synthetic resin, insoluble in gasoline, oil, ether, and alcohol. Has extreme lightness (weight about one-half that of aluminum), great toughness and strength, good elasticity, and a high degree of flexibility.	Used chiefly in fuel and brake lines; in lubrication systems for automotive equipment, aircraft, and Diesel engines; in chemical and process industries for conveying solvents and oils; and in hydraulic lines.

Review of Some Recently Developed Materials - Continued

Class of Material	Trade Name	Properties	Applications
Synthetic Substitute for Zinc Coating	**Roxaprene**	A corrosion-resistant synthetic coating that has shown a high degree of protection against caustic and acid solutions, in comparison with zinc coatings.	Used as a substitute for galvanized coatings on air-conditioning equipment, motor trucks, fans, blowers, pumps, and special machinery.
Vinylidene-chloride Plastics	**Saran**	Group of plastics ranging from a flexible, moderately soluble material with a softening point of 70 degrees C. to a hard, tough thermoplastic solid with a softening point of at least 180 degrees C. Tensile strengths range up to 60,000 pounds per square inch. These materials have a high degree of flexibility and resistance to fatigue. They are odorless, tasteless, non-toxic, and are characterized by extreme chemical resistance.	Available in the form of strong, flexible, rattan-like strands, extruded tubing, and other shapes. Used as a resinous bonding agent for new type of abrasive wheel. Can be molded by compression or injection. Almost any shade of color and degree of opacity can be obtained.
Stainless-steel Clad Sheets	**Silver-Ply**	Mild steel sheets and plates of flange quality, bonded with stainless steel of 3 to 50 per cent of the total thickness. These sheets can be bent, spun into deep heads, deep-drawn, drilled, and otherwise worked with greater ease than solid stainless steel.	Useful for manufacture of cooking vessels, storage tanks, marine equipment, and other applications where corrosion and erosion are problems.
Powdered Metal	**Sinterloy**	A powdered metal than can be pressed into practically any shape and sintered to produce a dense, homogeneous steel. The forming pressure is 50 tons per square inch, and sintering is usually accomplished at 1965 to 2100 degrees F.	Suitable for production of such parts as gears, cams, pump rotors, washers, pins, rivets, and splined shafts. Said to compare well with cast steel and cast alloy steel.
Open-hearth Steel	**Speed Case**	A specially processed, low-carbon, open-hearth, case-carburizing steel having the machinability of S A E 1112 and X1112 Bessemer screw stock, and the strength of S A E 1020, X1020, X1314, and X1315 open-hearth steels. Relatively high sulphur content makes dry machining possible. Can be cut at surface speeds of 220 to 300 feet per minute with greatly increased tool life.	Suitable for all types of broaching operations and cold heading, rolling, or crimping. Makes sound forgings and after forging, machines rapidly. Is readily welded by either electric-arc or gas process. Also useful for non-magnetic applications.
Metal Adhesive	**Strangl-Hold**	A two-element adhesive consisting of a powder and a liquid which are mixed shortly before using. A metal-to-metal joint, 3 by 3 inches, will support approximately 1350 pounds. A glass-to-metal joint of the same size will support up to 1650 pounds. The adhesive is unaffected by many corrosives, but is attacked by rubber solvents and by copper and manganese in solution.	Suitable for joining metal to metal, glass, wood, or other materials, glass to glass, and wood to wood or glass. Also makes an excellent coating for protecting metals of all kinds against atmospheric and other forms of corrosion.
Plastic Valve Packing	**Super-Seal**	Improved packing that utilizes non-frictional, vulcanized tape in place of frictional woven-cotton jacket. The packing contains a dry-graphitized plastic material made from long-fiber asbestos, anti-frictional metal particles, and special binders.	Suitable for centrifugal and rotary service, as in feed-pumps, low-pressure steam rods, expansion joints, etc.
Aluminum Alloy	**T-1**	A copper-tin-magnesium-zinc alloy of aluminum developed for heat-treated sand castings. Without heat-treatment, it has a tensile strength of 30,000 to 33,000 pounds per square inch; an elongation in 2 inches of 6 to 10 per cent; and a Brinell hardness of 60 to 78. Also has good resistance to salt water corrosion.	Can be used without heat-treating and quenching, and can be welded without deterioration in physical properties. Meets all requirements of U. S. Air Corps Spec. 11324 and 11325, and U. S. Navy Aeronautical Spec. M-397.
Floor Covering and Filler	**Tred Seal**	A liquid covering that can be applied to floors with a steel trowel for surface protection, and is ready for heavy service six hours after application.	Serves as a waterproofing, crack-filling, and splinter-proof covering for wood or concrete floors.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Copper Alloy	**Trodaloy**	A copper alloy containing beryllium and chromium that is much harder and tougher than copper. Particularly useful in withstanding the high pressures and impacts encountered in welding.	Useful for welding electrodes, switch plates, cams, spring fingers, and mechanical parts requiring high electrical conductivity.
Alkaline Copper-plating Process	**Unichrome**	An alkaline copper-plating process that provides a smooth, fine-grained base for bright nickel-plating. The plating bath is non-corrosive to flesh, clothing, and equipment, and forms no salt crust on tank, work-rods, or anodes.	Use of this process makes possible a reduction in the amount of nickel used for plating.
Magnetic Alloy	**Vicalloy**	An alloy composed of cobalt, vanadium, and iron that can be made to hold more permanent magnetism than any commercial material previously developed. It can be drawn and rolled without losing its magnetism.	This alloy has been applied in the form of a tape for sound recording purposes.
Welding Rods and Fluxes	**Weldoloy**	Rods and fluxes for oxy-acetylene welding and brazing at low temperatures. Various types are available for different classes of work. *Type CI-514*, which is the color of cast iron, is a medium hard material with good machining qualities. It has a fusing temperature of 1500 degrees F. and a tensile strength in the weld of 47,000 pounds per square inch. *Type ST-516*, of a silver-white color, has a fusing temperature of 1350 degrees F., a weld tensile strength of 110,000 pounds per square inch. *Type BU-685*, which is of bronze color, has a fusing temperature of 900 degrees F., a tensile strength of 100,000 pounds per square inch, and a Brinell hardness of 235. It is noncorrodible, has a low coefficient of friction and can be highly polished.	*Type CI-514* is used for welding cast iron, filling up blowholes, and building up new material on worn-out castings. *Type ST-516* is used for butt-welding steel, stainless steel, chromium-nickel steel, molybdenum and vanadium steels, Carboloy and tungsten-carbide alloys, mild steel, and malleable cast iron. It is particularly suitable for welding thin steel sheets and tubing. *Type BU-685* is used for building up materials on worn-out parts of steel, cast iron, copper, brass, bronze, and nickel alloys. Useful for repairing guide faces, valve-seats, ship propellers, etc. *Type BB-518* is used for welding brass, bronze, copper, aluminum-bronze and nickel, and for welding copper alloys to iron, galvanized iron, and steel; *Type WM-688* for white-metal die-castings; *Type SA-690* for sheets and tubes of aluminum and its alloys; and *Type CA-710* for welding aluminum castings and for building up new material on worn parts.
Tool and Die Steel	**Windsor Special**	A chromium-molybdenum-vanadium type of steel which is air-hardening, easily machined, extremely tough, and has a wide hardening range.	Useful for tools or dies where the initial cost must be kept at a minimum. Can be hardened or tempered in either oil or air.
Plastic and Metal Adhesives	**XL-5041** **XL 5075**	Adhesive solutions made of Vinylite resins, which produce strong, impact-resistant, metal-to-metal or phenolic-to-phenolic bonds. Joining of parts is under heat and pressure.	Tension tests indicate a shear strength of 6000 pounds per square inch; impact strength is better than that obtained with regular grades of polyvinyl acetate.

Gear Production Continues at High Level

The American Gear Manufacturers Association reports that industrial gear sales for August, 1941, were 44.5 per cent above August, 1940. For the eight months ending with August, 1941, the sales were 109 per cent above the corresponding period of 1940—a most phenomenal increase in gear production. This applies to industrial gears only. The compilation does not include automotive gears or gears used in high-speed turbines.

Reshaping Standard Carbide Tools for Special Operations

WITH the increased demands on cutting tool production, it is difficult to obtain special tools. Most large tool manufacturers are concentrating, as far as possible, on mass production of standard tools in order to obtain greater output at lower production costs. These conditions have led many ingenious shop men, when in need of specially shaped tools, to purchase the standard varieties and convert them to special shapes by simple grinding operations. Usually, it is found that in addition to the faster delivery possible on such standard tools, the cost of the tool plus the labor of regrinding the tool to a special shape is lower than the cost of a specially designed tool.

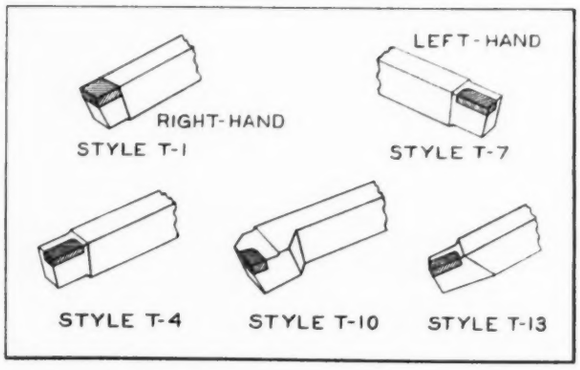


Fig. 1. Standard Carbide Tools before Reshaping for Operations such as Under-cutting, Grooving, Chamfering, Forming, Boring, and Special Turning

The accompanying illustrations show a few examples taken from various plants, of the adaptation of Carboloy tools to special machining operations. Fig. 2 shows how a Style T-1 standard tool, such as shown in Fig. 1, has been converted to perform a special undercutting operation on a part chucked in a lathe. Another operation for which the Style T-1 tool can be used is shown in Fig. 3. Here the tip end of the tool has been ground with a relief on each side to provide clearance for machining a groove in an annular part. The corners of the tip are slightly rounded for this operation.

Two more operations that formerly required special tools, but are now being performed with converted T-1 tools, are shown in Figs. 4 and 5. The first shows a V-grooving operation, for which the sides of the tool tip have been ground off to an angle corresponding to the shape of the vee. The second (Fig. 5) consists of under-cutting an annular part. For the latter case, the T-1 tool has merely had its corners rounded and has been ground to give the proper relief angles. In operation, the tool is fed into the rotating part in a direction parallel with its axis of rotation until the required depth of cut is reached. It is next fed toward the center and then away from the center to produce the shape of under cut required.

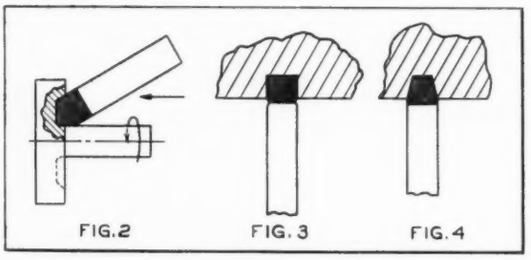


Fig. 2. Under-cutting with Reshaped Style T-1 Carbide Tool. Fig. 3. Grooving with a T-1 Tool. Fig. 4. V-grooving with a Reshaped T-1 Tool

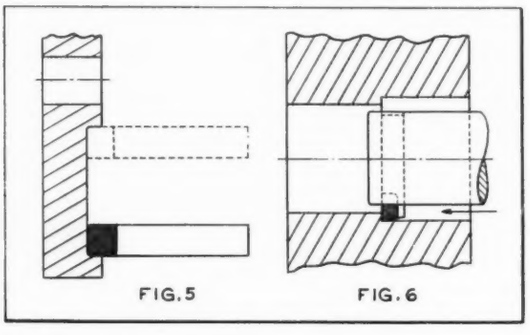


Fig. 5. Adaptation of a T-1 Tool for Undercutting. Fig. 6. Adaptation of a Style T-4 or T-7 Carbide Tool for Boring

The use of standard turning, facing, and forming tools for boring operations is illustrated in Fig. 6. Here a Style T-7 tool has been cut off and mounted in the boring-bar after grinding the proper relief angles. Another adaptation of this general type of tool is shown in Fig. 7, where a chamfering operation is being performed with a tool, the corner of which has been ground off to the correct angle.

Fig. 8 shows an operation normally requiring two special tools. A Style T-1 tool, as seen at the right, has been form-ground to produce the special shape required on the face of the part, while a T-7 tool, at the left, has been adapted to a special turning operation requiring an angular setting of the tool. Another operation in which reshaped standard tools are com-

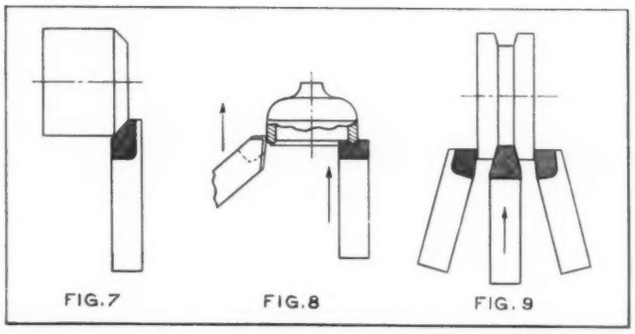


Fig. 7. Adaptation of a Style T-4 or T-7 Tool for Chamfering. Fig. 8. Style T-4 or T-7 Carbide Tool Reshaped, as Shown at the Left, for Turning Operation, and Style T-1 Tool Reshaped, as Shown at the Right, for Forming. Fig. 9. Style T-1 Carbide Tool Adapted for Turning Center V-groove, and Styles T-4 and T-7 Tools Adapted for Facing Operations

bined is shown in Fig. 9. Here the central tool is similar to that shown in Fig. 4, while the right- and left-hand tools used for facing the part are adaptations of Styles T-4 and T-7.

Fig. 10 shows a converted T-13 type of tool being used for turning following a plunge cut. Fig. 11 shows an adaptation of a T-10 tool for turning, with the tool mounted in the lathe turret. Fig. 12 shows how a Style T-1 tool has been ground to a special form for machining a spherical seat in the end of a part by the use of a simple plunge cut.

* * *

Yoder and Linde Collaborate in Developing Tube-Welding Machine

In the description of the oxy-acetylene tube-welding machine that appeared on page 171 of September, 1941, MACHINERY, mention should have been made of the fact that the machine was developed by the Yoder Co., 5500 Walworth Ave., Cleveland, Ohio, in collaboration with The Linde Air Products Co., New York City.

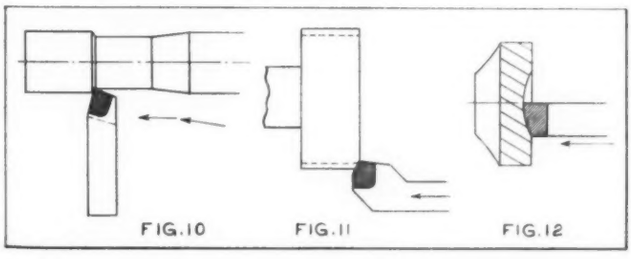


Fig. 10. Reshaped Style T-13 (Right-hand) or T-14 (Left-hand) Carbide Tool being Used for Turning following a Plunge Cut. Fig. 11. Turning with a Reshaped Style T-10 (Right-hand) or T-11 (Left-hand) Tool. Fig. 12. Forming with a Reshaped Style T-1 Tool

Reducing Aluminum Content of Zinc Die-Castings

Owing to the shortage of aluminum, considerable interest has recently developed in the possibility of reducing the aluminum content in zinc die-casting alloys. Under the sponsorship of the Committee on Die-Cast Metals and Alloys of the American Society for Testing Materials, a series of investigations has been started on this subject.

The two zinc alloys most commonly used today in the die-casting industry are ASTM Alloys XXIII and XXV, both of which normally contain about 4 per cent aluminum and 0.03 per cent magnesium. The composition of Alloy XXV differs from that of Alloy XXIII solely by the inclusion of 1 per cent copper, and both alloys are compounded with 99.99 per cent pure zinc. The adoption of this aluminum content in the development of these alloys was based largely on the good casting properties, coupled with what appeared to be the optimum combination of physical properties, and both of these alloys have been in commercial use for over ten years with satisfactory service records.

Because of the aluminum shortage, the Conservation Section of the Office of Production Management urged consideration and test of zinc alloys containing 1 1/2 per cent aluminum instead of the normal 4 per cent. Up to the present time, tests covering the casting of a wide variety of sizes and shapes with alloys having the lower aluminum content have indicated considerable difficulty in attaining commercial efficiency in casting parts of large size or of complex character. In some instances, these difficulties have been overcome by increasing the aluminum content from 1 1/2 to 2 per cent, while in other cases, it has been necessary to make further aluminum additions up to the normal 4 per cent.

These difficulties have been reported as generally due to the difference in solidification shrinkage characteristics and the greater hot-shortness of the low-aluminum alloys. In spite of the probability that a large number of relatively small and simple castings can be successfully made with these alloys, the available evidence indicates that many castings cannot be produced successfully with alloys of reduced aluminum content.

In general, it appears that, while the physical properties of the low-aluminum alloys are somewhat lower than those of the alloys with the normal 4 per cent content, they are probably adequate for most applications. Considerably more data are required, however, before this can be definitely confirmed for the information of both producers and consumers of zinc-alloy die-castings.

* * *

In Great Britain, women are now employed to a great extent in machine shops, whole departments being operated entirely by women.

Defense Production Meeting in St. Louis

THE American Society of Mechanical Engineers held a national defense production meeting at the Hotel Chase, St. Louis, Mo., September 9 to 11. Considering the great activity in industry and the extreme pressure on business executives and engineers at the present time, the meeting was unusually well attended. A great number of papers on various phases of armament manufacture were read and discussed. In all, eleven separate sessions were conducted, covering tank manufacture, aviation, chemicals and explosives, plant protection, small-arms ammunition, electric power, foundry work in defense production, production machine tools, fuels and lubricants, multiple production problems in shell manufacture, and the relation of the Office of Production Management to industry.

At the session on tank manufacture, two papers were read. Lieutenant Colonel John K. Christmas, chief of Tank Division, U. S. Ordnance Department, Washington, D. C., read a paper on "Modern Tanks"; Frederick A. Stevenson, senior vice-president of the American Car & Foundry Co., New York City, spoke on "Building Combat Tanks for the U. S. Army."

The subject "Plastics Applied to Airplane Structures" was dealt with by Charles E. Marschner, engineering department of the McDonnell Aircraft Co., St. Louis, at the aviation session. "Chemicals on the Defense Front" was the subject of a paper by Robert R. Cole, vice-president and general manager, Phosphate Division, Monsanto Chemical Co., St. Louis. "Chemical Warfare and National Defense" was covered by Lieutenant Colonel George W. Carnachan, of the Chemical Warfare Service, Sixth Corps Area, Chicago, Ill. A paper entitled "Manufacture of Explosives" was presented by Dr. Jules Bebie, consulting chemical engineer, St. Louis.

At the session on plant protection, some very important facts were brought out of value to all industrial executives; among the speakers were G. B. Norris, special agent in charge of the Federal Bureau of Investigation, St. Louis, and Lieutenant Commander James K. Vardaman, Jr., officer in charge of Naval Intelligence Service, Ninth Naval District, St. Louis.

A most interesting address was made to the entire group of those attending the sessions by W. Stuart Symington, president of the Emerson Electric Mfg. Co., St. Louis, who has recently returned from England. Mr. Symington spoke on "Observations on British versus American Defense Methods." A prominent officer of the Royal Air Force temporarily in this country was also present, and gave an inspiring address on the determination of the British people to defend not only their country, but the democratic institutions for which that country stands.

At the session on small-arms ammunition, Colonel J. Kirk, commanding officer, Frankford Arsenal, Philadelphia, Pa., gave a detailed description of the methods used in manufacturing rifle cartridges, following the methods through step by step. B. E. Bassett, general manager, U. S. Cartridge Co., St. Louis, spoke on "Production Problems in Small-Arms Manufacture."

The importance of electric power in national defense and the tremendous load that has been placed upon electric power stations by the sudden development in the arms industries were referred to in an informative address on "Power for Defense" by Dr. William McClellan, president, Union Electric Co. of Missouri, St. Louis, Mo.

Three papers of importance were read at the foundry session. The first, "Cast Armor Plate," was presented by H. M. Rishel, works manager, American Steel Foundries, Granite City, Ill.; the second, "Gray-Iron Castings," by Carl Morken, chief engineer, Carondelet Foundry Co., St. Louis; and the third, "Steel Castings in Defense Production," by Claude Harrell, vice-president, Sterling Steel Castings, Monsanto, Ill.

In addition to a general address on the machine tool industry, its accomplishments in connection with defense production, and its importance in the entire Defense Program, by Tell Berna, general manager, National Machine Tool Builders' Association, the session on production machine tools dealt specifically with precision work in various branches of armament production. A. M. Johnson, president, Barnes Drill Co., Rockford, Ill., read a paper, "Honing Process in National Defense," covering, in broad outline, what has been accomplished by honing and the present scope of that process. A more detailed survey of the honing process was presented by L. S. Martz, research department, Micromatic Hone Corporation, Detroit, Mich., who spoke on "Honing Tools and Related Equipment."

At the session on fuels and lubricants, C. M. Larson, consulting engineer, Sinclair Refining Co., New York City, spoke on "Need for Cooperative Planning for Greater Utilization of Fuels and Lubricants in National Defense Equipment." At the shell manufacturing session, J. H. Loux, Salem Engineering Co., Salem, Ohio, spoke on "The Witter Process for Rapid Production of Shell Forgings."

Finally, at the session dealing with the work of the Office of Production Management, J. D. Eby, manager of purchases, Wagner Electric Co., St. Louis, dealt with various problems met with in obtaining defense materials, and Joseph L. Trecker, of the Kearney & Trecker Corporation, now with the Defense Contract Service, Washington, D. C., spoke on "Cooperation of the Office of Production Management with Industry."

Machine Tool Dealers' Annual Meeting

THE annual meeting of the Associated Machine Tool Dealers of America, with headquarters at 505 Arch St., Philadelphia, Pa., was held at Hot Springs, Va., Friday and Saturday, September 12 and 13. A great many of the problems now confronting the machine tool industry in general, and the machine tool dealers in particular, were thoroughly discussed, both in the open and in the executive sessions of the meeting.

The meeting was opened by the president of the Association, F. B. Scott, Jr., of the Syracuse Supply Co., Syracuse, N. Y. Following the president's opening remarks, Dan Harrington, of the Wilson-Brown Co., New York City, spoke on the subject "The Sale of Electric Motors and Controls as It Affects Manufacturers and Dealers." This paper was followed by a discussion on the subject "Terms of Sales Payment and Their Relations to Cancellations" led by N. P. Lloyd, of Lloyd & Arms, Inc., Philadelphia, Pa. The meeting was also addressed by A. B. Einig, of the Tools Section, Office of Production Management, Washington, D. C., who referred to various questions and problems arising in connection with the government's machine tool program, questions of equal importance to dealers and manufacturers.

At the executive session, which was held Saturday morning, September 13, reports of various officers and committees were made, including the committees on ethics, membership, regional meetings, government relations, and sales research.

At the annual dinner, held Friday evening, September 12, the members of the Association were addressed by Tell Berna, general manager of the National Machine Tool Builders' Association. On this occasion, a thought-provoking address was also made by E. C. Brandt, of the Westinghouse Electric & Mfg. Co., on the subject "After the Defense Program—What?"

The following officers were elected to serve during the coming year: President, F. B. Scott, Jr., Syracuse Supply Co., Syracuse, N. Y.; vice-president, Albert M. Stedfast, Stedfast & Roulston, Inc., Boston, Mass.; and secretary-treasurer, G. J. Zimmerman, of Strong, Carlisle & Hammond Co., Cleveland, Ohio.

James W. Parker, President of the A. S. M. E. for 1942

JAMES W. PARKER, vice-president and chief engineer of the Detroit Edison Co., Detroit, Mich., has been elected president of the American Society of Mechanical Engineers for the year 1942. Mr. Parker will take office during the annual meeting, to be held in New York City early in December, this year.

Mr. Parker was born in Auburn, N. Y., in 1886. His family moved to Kentucky when he was four years old, and his boyhood was spent in Louisville. He graduated from Cornell University in 1908 with the degree of Mechanical Engineer. He then served an apprenticeship, first with the DeKalb Power & Light Co., in Illinois, and then with the Vincennes Street Railway Co., Vincennes, Ind. In 1910, he became boiler-room engineer for the Detroit Edison Co., with which company he is still connected.

In the course of his employment, he has organized and directed the various engineering projects of this company for the last twenty years. In addition to supervising new construction, he has also had general responsibility for the operation of the Detroit Edison system and of its generating plants.

James W. Parker, Newly Elected President of the A.S.M.E.

Mr. Parker served ten years as a trustee of Cornell University. In 1935, he was awarded the honorary degree of master of science in mechanical engineering by the Detroit Institute of Technology. He has just served a three-year term as president of the Engineering Society of Detroit, having been a director since the organization of that Society in 1936. He has been a member of the American Society of Mechanical Engineers since 1913. From 1928 to 1933, he served as a member of the Committee on Meetings and Program. He was a member of the Society's Council as a manager from 1935 to 1938, and a vice-president from 1938 to 1940. He has been a member of the executive committee of the Society for the last four years.

During the first World War he served in the Nitrate Division of the Ordnance Department, United States Army, as consulting mechanical engineer and as head of the inspection section of the Nitrate Division.

The Honing Process in National Defense

An Outline of the Application of the Honing Process and of the Required Characteristics of Honing Machines, as Presented in a Paper Read before the Defense Production Meeting in St. Louis, on September 10, by A. M. Johnson, President, Barnes Drill Co., Rockford, Ill.

HONING is utilized in a wide variety of manufacturing processes. It is commonly thought of in connection with the final finishing of cast-iron cylinders; but with the development of improved machines, tools, and abrasives, it has become possible to hone soft as well as hardened steels. With the development of the airplane engine came, first, the honing of cylinders, and then the finishing of various bearings and pin-holes, such as crank and piston-pin holes of radial-engine main-rods. It was found also highly advantageous to hone the articulating-rod pin-holes in the main-rod, as damaging scratches were removed in this way and practically a 100 per cent bearing obtained by the pin. Formerly the burden was put upon the hone of producing a hole accurate in diameter, round, and free from taper. With the coming of the radial engine with aluminum heads shrunk on their steel cylinders, the requirement in some cases was for a bore several thousandths inch smaller at the head or blind end, to allow for greater expansion at that point. This result has been accomplished by the use of special honing tools, together with proper technique in the operation.

There are many other parts, such as propeller hubs, shaft extensions, etc., that must have accurate fits; and in the case of some parts, it is necessary to have the holes free from scratches, as scratches might cause fractures to develop. This is true of an accessory drive-shaft, about 4 feet long, having a 3/4-inch hole three-quarters of its length, and the remainder being 7/8 inch in diameter. Fractures of this shaft, which sometimes occurred when the hole was reamed, were eliminated after the honing process was adopted.

Honing has made possible the proper functioning of the landing gear of airplanes. The shock cylinders, as well as those needed for retracting the landing gear and many other cylinders for operating various devices of a military plane, are now being honed.

It frequently becomes necessary to hone to the bottom of a blind hole or to a shoulder. In these cases, it is the practice to leave slight recesses at the bottom in the previous machining operations. By the use of a special hone and by having the machine equipped with a mechanism for positive stopping and timed dwelling, a uniform diameter can be produced.

Vertical machines are much more convenient to operate than the horizontal type, and should be used when the work is not too long. A vertical machine has been built with a stroke of 8 feet to hone up to 30 inches in diameter. This machine was 32 feet high, and was equipped with a hydraulically operated in-and-out table to afford ease of loading and convenience of gaging.

Smaller machines cover the field down to the minimum diameter for which it is practical to make honing tools, which is about 1/4 inch. Horizontal machines are used extensively for honing gun bores from about 7/8 inch in diameter up to the largest naval guns. Machines with a stroke of 75 feet have been built for honing up to 30 inches in diameter.

Recuperator cylinders require a high degree of accuracy and finish. It is necessary with certain types to hone with a non-rotating motion, parallel to the axis, except at the ends of the stroke. This is termed co-directional honing. This procedure is necessary to change the microscopic cross-hatch lines into lines parallel with the piston travel.

It is necessary to have accurate diameters and fine finishes on piston-rods for recoil and recuperator cylinders. Here, again, the honing process produces the desired results. For this purpose, the work to be externally honed is rotated between centers which are reciprocated on a long carriage; the hone is mounted on a floating support attached to the machine frame. When it is necessary to produce a co-directional finish, the hone is mounted on a light-weight carriage to facilitate rapid reciprocation, and the piston-rod is held between stationary centers and rotated a few degrees at the end of each stroke.

In machining gun bores by boring, ordinarily about 0.040 inch on the diameter is left for the finish-boring operation. When the honing process is employed, a less amount can be left for the final finish, with practically no likelihood of scoring the tube to a depth such that the honing will not remove it. Honing up to the finished diameter leaves a smooth finish, free from damaging scratches, and an accurate finish within very close tolerances.

Characteristics of Honing Machines

The important requisites of a honing machine are ruggedness and sufficient power, uniform rate of travel, extremely rapid deceleration and acceleration at the ends of the stroke, convenient fix-

tures for holding the work, and ample quantity of a proper coolant, well filtered.

First, the machine must have sufficient stiffness in its frame; and even more important, its rotation driving train, including gears, shaft, and spindle, must resist any tendency to set up torsional vibration. It is advantageous, especially when honing large diameters, to have the hone heavy enough to produce a flywheel effect, thus aiding the machine in producing a steady, vibrationless, rotary motion of the honing sticks. This provides better cutting conditions and longer life of the abrasives.

Second, the machine must have sufficient power to drive the hone under varying conditions, as in roughing different materials, both soft and hardened. Obviously, the abrasive stick pressure against the wall is a measure of the power required, which is generally proportionate to the abrasive area acting on the surface times the rotating speed in feet per minute.

Third, the rapid deceleration and acceleration at the ends of the stroke are important in preventing enlarged diameters at the ends of the holes. Also, a quick reversal of the reciprocation appreciably increases production, as more passages of the abrasives can be made over the surface per unit of time. The rate of reciprocation varies from 30 to 250 feet per minute, depending upon the material, revolutions per minute, and diameter of hone.

It is necessary to have a copious supply of clean coolant delivered to the hone to carry away the minute particles of material removed from the walls and to keep the abrasive sticks in a free-cutting condition. There are several recommended kinds of coolant. Kerosene is employed for honing cast iron, and is used in connection with many other compounds. When honing soft steels, it is necessary to use a coolant that will prevent the particles of steel from embedding themselves in the surfaces of the sticks, thus causing scores and scratches in the surface. To prevent this condition, a lubricant must be added. One of the commonly used coolants on difficult jobs is a compound of oleic acid, turpentine, and kerosene. Another is pure lard oil, with certain percentages of kerosene.

A question often asked is: "How fast can a hole be enlarged by the honing process?" This is difficult to answer with any degree of certainty, as the condition and hardness of the material honed affect the honing time greatly. In general, good yardsticks would be the results shown in the following cases: A gun tube, 5 inches in diameter and 23 feet long, can be honed at the rate of about 0.014 inch off the diameter per hour. About 0.018 inch of stock was removed from a gun tube 3 5/8 inches in diameter by 13 1/2 feet long in one and one-half hours. A gun tube 7/8 inch in diameter by 6 feet long was honed, removing 0.006 inch of stock, at the rate of three pieces per hour; 0.050 inch of stock was removed from a recuperator cylinder 52 inches long and 4 1/2 inches in diameter in forty-five minutes.

The time required to hone a certain piece depends on the accuracy of the preceding operation and the amount of stock left, the type and hardness of the materials, the tolerance allowed, and the fineness of the finish required. Generally, the honing process is not a difficult one; but at the beginning of a job, considerable care should be given to using the proper speeds, both rotating and reciprocating, to the intelligent choice of abrasive sticks, and to selecting the best coolant for that particular material. If these conditions are satisfied reasonably well, no trouble should be experienced in producing surfaces, both internal and external, conforming to close tolerances as to size and finish.

* * *

Mechanical Engineers to Meet in Louisville

The fall meeting of the American Society of Mechanical Engineers will be held in Louisville, Ky., October 13 to 15, with headquarters at the Brown Hotel. During the meeting, sessions will be held on fuels, rubber and plastics, aviation, safety, education and training, wood industries, management, power, and machine shop practice. At the shop practice session, which will be held Wednesday morning, October 15, M. F. Judkins will read a paper on "Manufacture of Shells," and W. P. Bearce will present a paper entitled "Industry Aids the Arsenals." Further information can be obtained by addressing Melvin Sack, general chairman, Louisville Fall Meeting, Henry Vogt Machine Co., 10th and Ormsby Sts., Louisville, Ky.

* * *

Consolidated Machine Tool Corporation Receives Navy Pennant

The Consolidated Machine Tool Corporation, Rochester, N. Y., builder of huge planers, lathes, and boring and turning mills used in ordnance manufacture, has been honored by the Navy Department by the award of the Navy's "E" pennant for excellence in defense production. The award took place in Washington, September 4. Arthur H. Ingle, president of the corporation; Alfred Trosch, vice-president; Robert L. Arms, Washington representative; and Charles R. Kalbfus, personnel manager, represented the firm on that occasion.

The official award in Washington was followed by award ceremonies in Rochester on September 25. The award consists of the Flag of the Bureau of Ordnance, Navy Department, and the Navy "E" pennant, with the privilege of flying these flags over the buildings of the corporation. The employes will receive lapel buttons bearing the Navy "E" and the name of the company.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Fill in on Form at Bottom of Page 159 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October Number of MACHINERY

Machinery and Tools

BROWN & SHARPE MFG. CO., Providence, R. I. General Catalogue 142, containing 640 pages covering the complete B & S line of machinery and tools, including milling machines, screw machines, grinding machines, machinists' tools, screw machine tools, cutters and hobs, and other shop equipment. 1

Electric Machinery

FAIRBANKS, MORSE & CO., 600 S. Michigan Ave., Chicago, Ill. 48-page "Catechism of Electrical Machinery," explaining electricity and magnetism as utilized in electric generators and motors, and describing the important features of direct- and alternating-current motors, generators, and control equipment. 2

Electrode Consumption Calculator

AIR REDUCTION, 60 E. 42nd St., New York City. Bulletin entitled "Airco Electrode Consumption Calculator," containing tables showing how many pounds of electrodes are required per linear foot for arc-welding any type of joint with either bare or coated electrodes. 3

Tantalum-Carbide Tools

VASCOLOY-RAMET CORPORATION, North Chicago, Ill. Bulletins G-408 and G-409, containing specifications and prices covering, respectively, Tantung "G" blades for inserted-tooth milling cutters, and Tantung "G" all-purpose tools with full-width blanks. 4

Training Mechanics with Moving Pictures

FILM PRODUCTIONS CO., 1504 Hennepin Ave., Minneapolis, Minn. Circular discussing the use of moving-picture films in training mechanics, and describing eight films available for training apprentices in machine shop practice 5

Magnetic Chuck Control

ELECTRO-MATIC PRODUCTS CO., 2235 N. Knox Ave., Chicago, Ill. Bulletin 21, containing complete information on the Neu-T-Rol magnetic chuck control for quickly releasing the work from magnetic chucks and, at the same time, demagnetizing the work. 6

Automatic Temperature Indicator

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Circular illustrating and describing the Micromax Model S self-balancing indicator for rapidly measuring the temperatures of a large number of thermo-couples. 7

Grinding Machines

LANDIS TOOL CO., Waynesboro, Pa. Catalogue entitled "Looking for Grinding Facts?" containing information on the construction and operation of Landis grinders, and showing specific examples of these machines in operation on a variety of work. 8

Defense Equipment

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., is distributing a monthly news sheet, known as *Defense Production News*, which will be devoted exclusively to the part played by Allis-Chalmers products in defense production. 9

Metal-Cutting Tools

MIDWEST TOOL & MFG. CO., 2360 West Jefferson Ave., Detroit, Mich. Catalogue 17, containing 192 pages covering a wide range of metal-cutting tools. Tables of feeds and speeds, cutter sharpening data, etc., are included. 10

Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Catalogue entitled "Individualized Inco Nickel Alloys," containing information on mechanical properties and applications of eight different nickel alloys. 11

Engineering Data Sheets on Ampco Metal

AMPCO METAL, INC., Milwaukee, Wis. 56-page booklet containing a collection of engineering data sheets giving information on the physical properties and specific applications of Ampco metal. 12

Electronic Micrometer

INSTRUMENT SPECIALTIES CO., INC., 253 Bergen Boulevard, Little Falls, N. J. Catalogue descriptive of the Carson electronic micrometer, designed to make precision measurements without pressure on soft, flexible materials. 13

Heat-Treating Furnaces

SURFACE COMBUSTION CORPORATION, Toledo, Ohio. Bulletin CM-41, describing the gas-fired Char-Mo atmosphere furnace, which is being used extensively at present for treating molybdenum steel without decarburization. 14

Powder Metallurgy

MORAINE PRODUCTS DIVISION, GENERAL MOTORS CORPORATION, Dayton, Ohio. Circular 102, on Durex iron, describing the application of powder metallurgy in producing bearings, gears, cams, and miscellaneous metal parts. 15

Blueprinting Machines and Equipment

C. F. PEASE CO., 2601 W. Irving Park Road, Chicago, Ill. Catalogue M-41, covering the Pease line of arc-lamp continuous blueprinting, washing, and drying equipment; blueprint paper and cloth; etc. 16

Drills and Reamers

WHITMAN & BARNES, 2108 W. Fort St., Detroit, Mich. Catalogue

97 (166 pages), covering the W & B line of twist drills, reamers, punches, and special tools. Technical data and information on the design, construction, use, and care of drills and reamers are included. 17

Engraving Machines

GEORGE GORTON MACHINE CO., 1316 Racine St., Racine, Wis. Circular 1635, descriptive of the Gorton munitions engraver, including production time on parts for planes, guns, ships, etc. 18

Hydraulic Honing Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Bulletin 147, describing the features and advantages of the "Barnesdril" No. 1 horizontal self-oiling hydraulic honing machine. 19

Plastics

GENERAL ELECTRIC CO., Pittsfield, Mass. Booklet descriptive of G-E Mycalex, which is particularly suitable for use in electrical apparatus, including radio, industrial control and heating equipment, etc. 20

Controllers for Temperature, Pressure, Etc.

BROWN INSTRUMENT CO., Wayne and Roberts Ave., Philadelphia, Pa. Catalogue 8903, on air-operated controllers for temperature, pressure, flow, liquid level, and humidity. 21

Cleaning Compound

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Booklet on Oakite compound No. 32, a material developed for the removal of hard water scales, rust, and similar deposits on metallic surfaces. 22

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Application Sheet 76 in a series on Machine Design, describing the application of welding in the design of an outboard bearing bracket for presses. 23

Welding Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin B-2285, on Flexarc alternating-current welders for every type of welding job, ranging from light-gage sheet to heavy-duty industrial fabrication. 24

Machine Tools in Aircraft Plants

DELTA MFG. CO., 605-L E. Vienna Ave., Milwaukee, Wis. Booklet entitled "New Wings for Production," showing numerous photographs of Delta-Milwaukee machine tools installed in aircraft plants. 25

Cutting Oils and Lubricants

D. A. STUART OIL CO., 2727 S. Troy St., Chicago, Ill. 48-page booklet entitled "The Straight Line to Metal-Working Efficiency," containing information on metal-cutting lubricants and their applications. 26

Oilless Bronze Bearings

R. W. RHOADES METALINE CO., INC., 50-17 Fifth St., Long Island City, N. Y. Catalogue covering the lubricating properties of Metaline oilless bronze bearings, the various types, and applications. 27

Precision Lathes

SOUTH BEND LATHE WORKS, 728 E. Madison St., South Bend, Ind. Condensed catalogue 52, briefly describing the South Bend line of precision lathes; information includes capacities, speeds, and feeds. 28

Sheet-Lifters

CULLEN-FRIESTEDT CO., 1305 S. Kilbourn Ave., Chicago, Ill. Bulletin SL 21, describing C-F sheet-lifters for lifting and carrying sheet steel and other material hard to handle. 29

Seam-Welders

TAYLOR-WINFIELD CORPORATION, Warren, Ohio. Bulletin 1001, illustrating and describing the standard line of Taylor-Winfield roller seam-welders; includes useful seam-welding data. 30

Materials-Handling Equipment

TOWMOTOR CO., 1226 E. 152nd St., Cleveland, Ohio. Catalogue entitled "Facts about Towmotor — the One-Man Gang," describing a power-driven truck with a telescopic lift for handling materials. 31

Brazing Alloys

HANDY & HARMAN, 82 Fulton St., New York City. Bulletin 12, on "Low Temperature Brazing of Metals with Sil-Fos and Easy-Flo for Speed, Strength, and Economy." 32

To Obtain Copies of New Trade Literature

listed on pages 158-160 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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Involute Measuring Machine

FELLOWS GEAR SHAPER CO., Springfield, Vt. Circular entitled "Checking Internal Spur and Helical Gears on the Fellows Involute Measuring Machine." 33

Motors for Machine Tools

GENERAL ELECTRIC CO., Schenectady, N. Y. Leaflet GEA-3579, on fractional-horsepower motors for machine tools and other industrial applications. 34

Crane and Hoist Motors

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet B-2264, descriptive of electric motors and controls for cranes, hoists, and gantry bridges. 35

Arc-Welding Training

HOBART TRADE SCHOOL, INC., Box EW-78, Troy, Ohio. Booklet entitled "You and Your Job in Arc Welding," outlining the welding course offered by this school. 36

Tool Grinders

HAMMOND MACHINERY BUILDERS, INC., 1600 Douglas Ave., Kalamazoo, Mich. Bulletin GP-12, describing three new OK grinders for tools and light snagging. 37

Industrial Lighting

HOLOPHANE CO., INC., 342 Madison Ave., New York City. Booklet entitled "Protective Lighting for American Industry." 38

Steel Factory Equipment

STANDARD PRESSED STEEL CO., Box 22, Jenkintown, Pa. Bulletin 566, illustrating and describing the Hallowell line of steel work-benches and factory equipment. 39

Carbide Tools

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa., is issuing a weekly stock sheet listing quantities of various standard Kennametal carbide tools carried in stock. 40

Pneumatic and Hydraulic Cylinders

GALLAND-HENNING MANUFACTURING CO., Milwaukee, Wis. Bulletin 82, descriptive of "Nopak" cylinders, designed for air or hydraulic service. 41

Heat-Treating Furnaces

DESPATCH OVEN CO., Minneapolis, Minn. Bulletin 83, covering the outstanding features of the Despatch CF line of tempering and drawing furnaces. 42

Chisel Steel

JESSOP STEEL CO., Washington, Pa. Bulletin containing data on the physical properties and heat-treatment of "Magic" chisel steel. 43

Magnetic Separators

STEARNS MAGNETIC MFG. CO., Milwaukee, Wis. Catalogue on magnetic pulleys and magnetic pulley separating units for reclaiming materials. 44

Hand Screw Machines

OSTER MFG. CO., 2073 E. 61st St., Cleveland, Ohio. Catalogue 27-A, describing the No. 601 "Rapiduction" hand-operated screw machine. 45

Spray-Painting Equipment

DEVILBISS CO., Toledo, Ohio. Circular descriptive of two new series of DeVilbiss spray-painting air-compressing outfits. 46

Dressing Grinding Wheels

DIAMOND TOOL CO., 938 E. 41st St., Chicago, Ill. Instruction card showing how to dress grinding wheels correctly. 47

Drawing Lubricants

MAGNUS CHEMICAL CO., INC., Garwood, N. J. Bulletin on Magnus drawing lubricants for ferrous and non-ferrous wire. 48

Pneumatic Hammers

INGERSOLL-RAND CO., 11 Broadway, New York City. Booklet 2775, listing the Ingersoll-Rand complete line of "Jackhamers." 49

Welding Electrodes

HOBART BROTHERS CO., Box EW-79, Troy, Ohio. Revised 20-page handbook of welding electrodes and accessories. 50

Vibration Isolation

B. F. GOODRICH CO., Akron, Ohio. Catalogue Section 7900, on Goodrich Vibro-Insulators. 50-A

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 161-180 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description on pages 161-180—or write directly to the manufacturer, mentioning machine as described in October, 1941, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

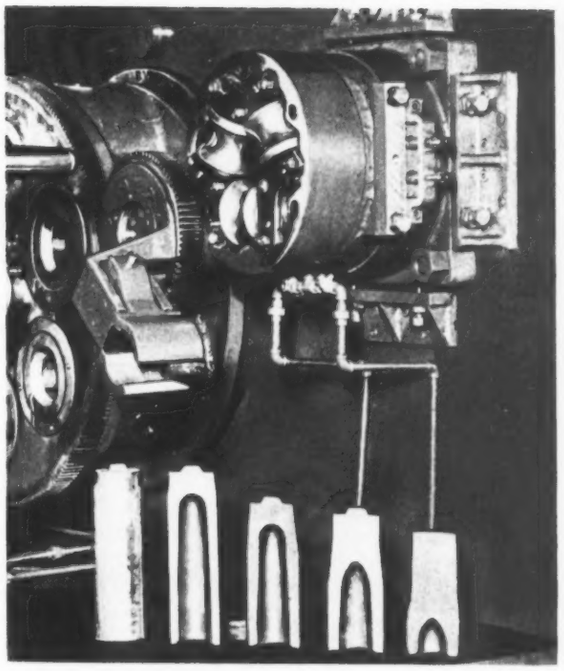
Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market



Clearing Automatic Shell-Forging Machine

A four-stage, automatic forging machine designed to produce from 240 to 300 finish-drawn, 90-millimeter shell forgings per hour from hot steel billets has been developed by the Clearing Machine Corporation, 6499 W. 65th St., Chicago, Ill. This machine eliminates all manual handling of work from the time the hot billet is placed in the descaler until the finish-drawn forging is deposited on a cooling conveyor. Production is claimed to be from three to five times that of conventional upsetting machines. Half-section views in the heading illustration indicate the work performed successively in each of the four operations that convert the steel billet into a finish-drawn shell.

In operation, the hot billet in the loading device shown in Fig. 2 is swung in front of the die by rotation of the die table to which the loading arm is geared. The first punch pushes the billet into the die on the first forward stroke, slightly upsets the square billet to seat it firmly in the die, and pierces it lightly. On the return stroke, the aligning guide on the punch strips the work from the punch. At the end of the return stroke, the die table indexes 60 degrees, bringing a cooling station in front of the first punch, while the die containing the

Fig. 1. Automatic Forging Machine Capable of Producing 240 to 300 Finish-drawn 90-millimeter Shells per Hour

To obtain additional information on equipment described on this page, see lower part of page 160.

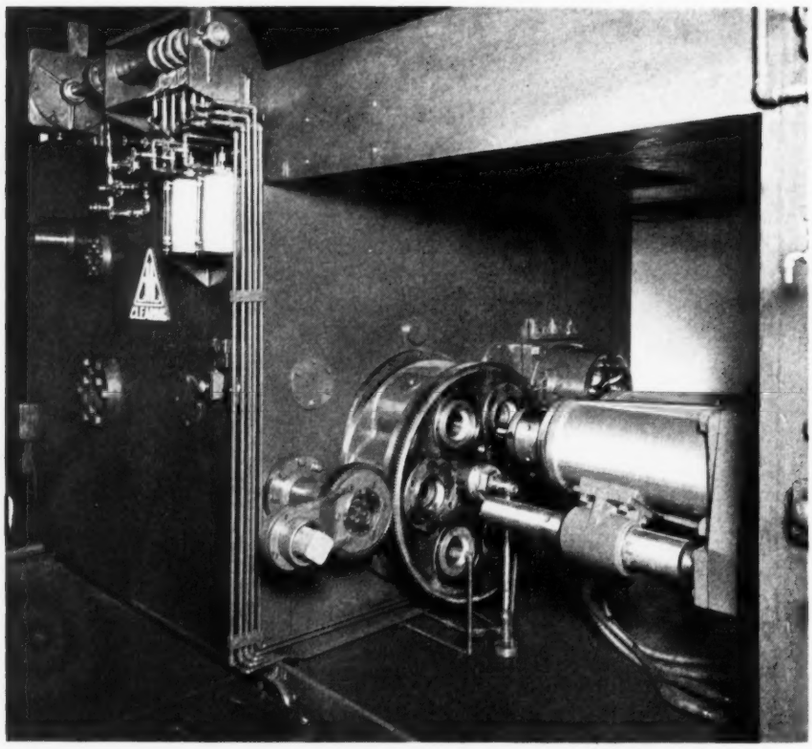


Fig. 2. Loading Side of Clearing Shell-forging Machine, Showing Heated Billet in Loading Carrier

lightly pierced billet moves around in front of the second punch.

On the next forward stroke, the first punch, after being cooled in air on the return stroke, is passed through the cooling station where it is brought to the correct temperature by a controlled hot water spray. On the return stroke through the opening in the die table, the punch is evenly sprayed with colloidal graphite lubricant to lubricate it for the next piercing operation.

At the same time, a second punch, on the forward stroke, pierces the shell and converts it from a square to a round shape. On the return stroke, the shell is stripped from the punch in the manner previously described. The die table then indexes another 60 degrees, bringing the forging in front of the third punch, a cooling station in front of the second punch, and a fresh billet in front of the first punch.

On the third forward stroke, the cavity of the first shell is finished, while the first punch is piercing the second billet, and the second punch is passing through the cooling station. The second punch is spray-lubricated on the return stroke while the shells are being stripped from the first and third punches.

On the next forward stroke, after the die table has again indexed 60 degrees, the finish-pierced shell is pushed out of the die into a carrier from the rear of the die, the third and first punches being cooled and lubricated while the second punch is piercing and the loading carrier is in position to receive another hot billet.

The next time the table is indexed, the transfer carrier, also geared to the die table and containing the pierced shell, is swung up in front of the drawing unit. On the next forward stroke, the drawing mandrel enters the shell and pushes it through a set of roller and ring dies, shown in the upper right-hand corner of the heading illustration, which draw the shell to its proper size. On the return stroke, the now finished shell forging is stripped automatically from the mandrel and delivered through a chute in back of the drawing dies to a conveyor for cooling.

The next indexing of the table swings the transfer carrier back into position to receive the second finish-pierced shell. On the next forward stroke, the drawing dies are sprayed with a mixture of air and water to cool them. On the return stroke, they are sprayed with a colloidal graphite lubricant. Further indexing of the table brings the die in which the first shell has been pierced into position to receive another billet.

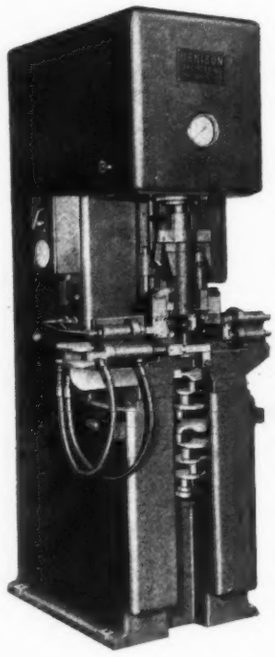
The lubricant tanks and cams to control the flow of lubricant are shown in the upper left-hand corner of Fig. 2.

A descaler can be added to the machine ahead of the automatic die loader. In that case, the billet is placed in the descaler, where the scale is automatically removed. A special device scrapes the end of the billet to be pierced, producing clean metal, a protection against scale spots in the cavity of the shell. From the descaler, the billet is automatically transferred to the dies by the loading carrier. 51

Denison "Hydroilic" Crankshaft Assembly Press

A press, designated the "Hydroilic," designed for assembling the keys and timing gear on automotive crankshafts, has been built recently for one of the automotive manufacturers by the Denison Engineering Co., 102 W. Chestnut St., Columbus, Ohio. The press is a special adaptation of one of the manufacturer's standard line of small-capacity hydraulic presses recently developed to meet the requirements for a press that can be readily modified to handle a wide variety of special production work.

The particular press illustrated has a 5-ton capacity and is entirely



"Hydroilic" Press Equipped for Assembling Keys and Timing Gear on Crankshafts

To obtain additional information on equipment described on this page, see lower part of page 160.

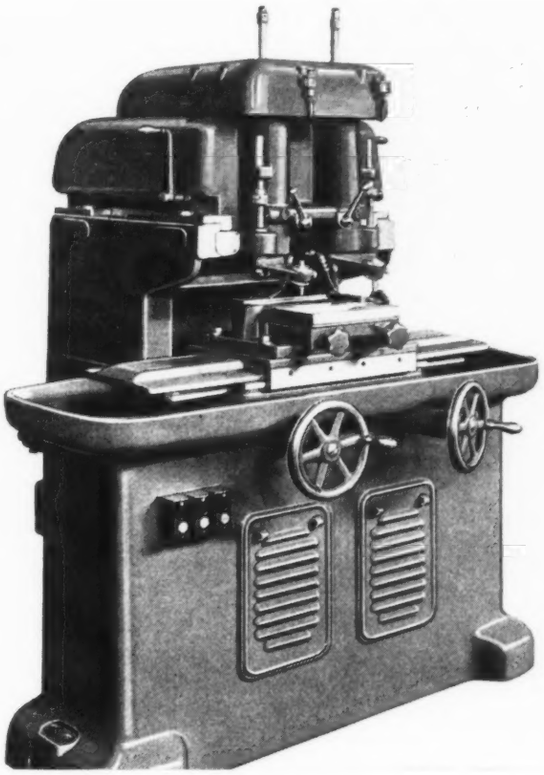


Fig. 1. "Red Ring" Hand Profiling Machine Brought out by the National Broach & Machine Co.

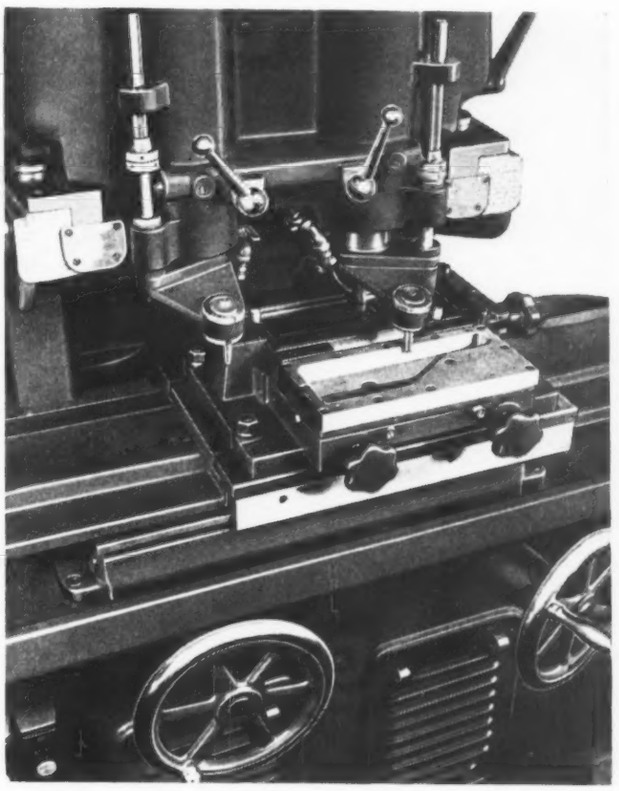


Fig. 2. Close-up View of the Cutter-spindles and Table of the Machine Shown in Fig. 1

automatic. The crankshaft is locked in place, and the keys are fed into the press through magazines. Four cylinders serve to assemble the two keys, and the timing gear is pressed into place by the ram. A special safety feature stops the operation of the ram if the keys are not pressed into place properly. The equipment is also arranged so that if the timing gear does not fit, the pieces are ejected. 52

Weltronic Resistance-Welding Heat Controls

A complete line of resistance-welding heat controls, designed to take care of practically every application of such controls to resistance-welding operations, has been developed by the Weltronic Corporation, 3070 E. Outer Drive, Detroit, Mich. The various models available are designed to take care of such applications as (1) single-weld operations, using either gun or pedestal type welders; (2) pulsation welding, requiring different amounts of current for different "shots," and (3) multi-spot welding as used with Hydromatic and Ultra-Speed welders, where individual adjustments are required for each weld or group of welds in the series. 53

"Red Ring" Hand Profiling Machine

A new "Red Ring" hand profiling machine has been designed by the National Broach & Machine Co., 5600 St. Jean, Detroit, Mich., for use in the production of intricate mechanical parts incorporated in the breech mechanisms of small arms and machine guns, and in the manufacture of certain aircraft parts and bearings. The profile of a master pattern employed as a guide for an end-mill can be duplicated in the work by this machine.

The machine head carries two cutter-spindles having a distance between centers of 10 inches, which can be used simultaneously. The head carrying the cutter-spindles moves toward and away from the operator as he faces the machine, the maximum travel of the head being 4 inches each side of the center position. The table, which has a capacity for two fixtures, moves laterally at right angles to the path of the head movement, the maximum travel being 10 inches each side of the center. This combination of cutter and table movements permits the cutter to travel over a table area of 160 square inches. Both slides are equipped with adjustable stops to limit the travel in either direction.

By locking either slide, linear milling operations can be performed without using a master pattern. Both the head and table movements in the horizontal plane are effected by handwheels at the front of the machine through helical gears and racks. One handwheel is provided for each slide.

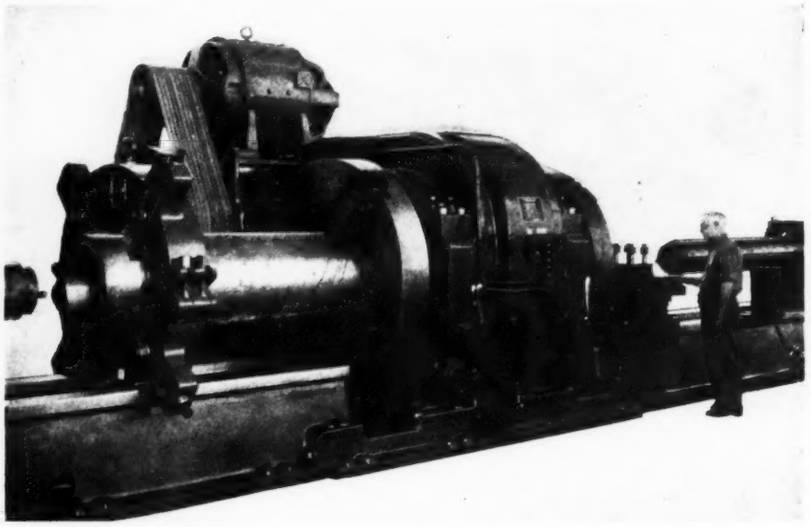
Although massive construction has been employed to eliminate vibration, both the head and the table are designed to respond instantly to finger-tip pressure on the handwheel and to insure smooth movements that facilitate the maintenance of constant bearing pressure of the guide pin on the contour of the master pattern. All slides are mounted on large-diameter precision roller bearings operating against hardened and ground tracks. Bearing and slide adjustments provide for the elimination of backlash or lost motion.

Each spindle has a micrometer adjustment for depth of cut and a spring counterbalance that provides for its instant retraction when the locking handle is released. The vertical cutter feed is actuated by cranks at each side of the head. Five spindle speeds are obtainable through stepped sheaves on the spindle and motor shafts. The drive is

To obtain additional information on equipment described on this page, see lower part of page 160.

by means of V-belts, each spindle having a separate motor. Standard tool-drivers of the collet type having a No. 9 B & S taper are employed. The tool-drivers have a capacity for holding end-mills up to 3/4 inch in diameter. A draw-bolt is used for locking the tool.

The follower pin is tapered to a 6-degree angle to correspond with the angle to which the sides of the master pattern are cut. This pin, in addition to having a vertical adjustment, has a 1/16-inch lateral adjustment to compensate for changes in cutter diameter resulting from sharpening. Coolant from a tank in the base of the machine is piped to a jet at each cutter position. 54



Double-end Boring Lathe for Large Gun Forgings, Built by Wickes Brothers

Wickes Double-End Boring Lathe

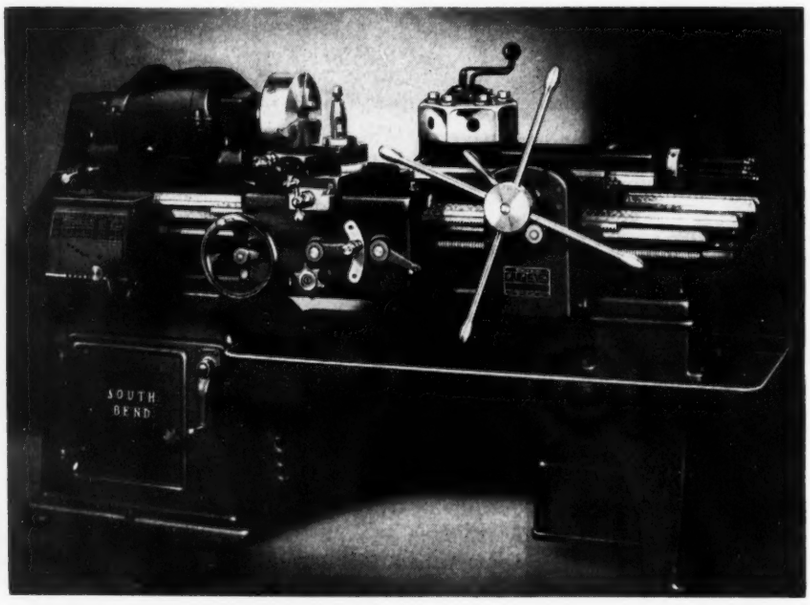
A new line of double-end boring lathes built by Wickes Brothers, Saginaw, Mich., includes the 30-inch by 25-foot by 25-foot machine shown in the accompanying illustration. This lathe is designed for boring hollow steel forgings, such as torpedo air flasks and guns.

The new machine has a 30-inch hollow spindle and a bed length at each end of 25 feet. Each end of the bed is equipped with a 12-inch by 20-foot forged-steel boring-bar, permitting the hollow forgings to be bored from both ends simultaneously. The machine is arranged with an independent feed-box on each end, driven by a variable-speed direct-current motor, and with power rapid traverse. The main drive is through a 50-H.P. variable-speed motor with three mechanical speed changes in the headstock.

The forged-steel work-piece is supported in and driven by the face-plates on each side of the center-drive headstock, and is also supported by four-jaw steadyrests. A portable spotting carriage is provided for the preliminary work on the end of the forging. The weight of the complete machine, including electrical equipment, is approximately 183,000 pounds. 55

South Bend Turret Lathe

A 16-inch turret lathe designed for rapid production on chucking operations and bar work has been introduced on the market by the South Bend Lathe Works, 728 E. Madison St., South Bend, Ind. This lathe has a 16 1/4-inch swing over the ways and saddle wings, and a swing of 9 5/8 inches over the toolpost saddle cross-slide. The hole through the headstock spindle is 1 3/8 inches in diameter, and stock 1 inch in diameter can be passed through the collet.



Turret Lathe for Bar and Chucking Work, Built by South Bend Lathe Works

The ram type turret has both power and hand feed, with automatic indexing and individual stop for each of the six turret faces. A quick-change gear-box provides forty-eight changes of turret power feeds, and there are forty-eight changes of feed for both the cross and longitudinal feeding movements of the toolpost carriage. Provision is made for cutting a series of forty-eight screw threads ranging from 4 to 224 threads per inch. The direction and speed of the turret feeds with relation to the carriage feeds can also be changed.

Twelve spindle speeds ranging from 10 to 731 R.P.M. are available on this machine. A two-speed motor permits quick change from high to low speed for reaming and tapping operations. The controls for the carriage, cross-slide, and turret are conveniently arranged, as shown in the accompanying illustration. 56

To obtain additional information on equipment described on this page, see lower part of page 160.

Front View of "Barnesdril" No. 1 Horizontal Hydraulic Honer, Showing Unitary Control Lever and Push-button Panel at Operating Position

"Barnesdril" Hydraulic Honing Machine

The Barnes Drill Co., 814 Chestnut St., Rockford, Ill., has just brought out a No. 1 "Barnesdril" hydraulic honing machine of the horizontal type, which has a capacity for honing long bores up to 1 1/2 inches in diameter. The standard working stroke of this size machine is 8 feet, but it can be made with a shorter stroke of 6 feet, or a longer stroke up to a maximum of 12 feet. It will swing work up to 16 inches in diameter.

Spindle speed changes are obtainable through pick-off gears within a range of 143 to 600 R.P.M. with a 5-H.P., 3600- or 3000-R.P.M. motor, one set of pick-off gears for any one speed in this range being furnished as standard equipment. The hydraulic system, operated by a 5-H.P., 1800- or 1500-R.P.M. motor, provides a feed range of 1 to 70 lineal feet per minute. The overall length of the machine is approximately 24 feet.

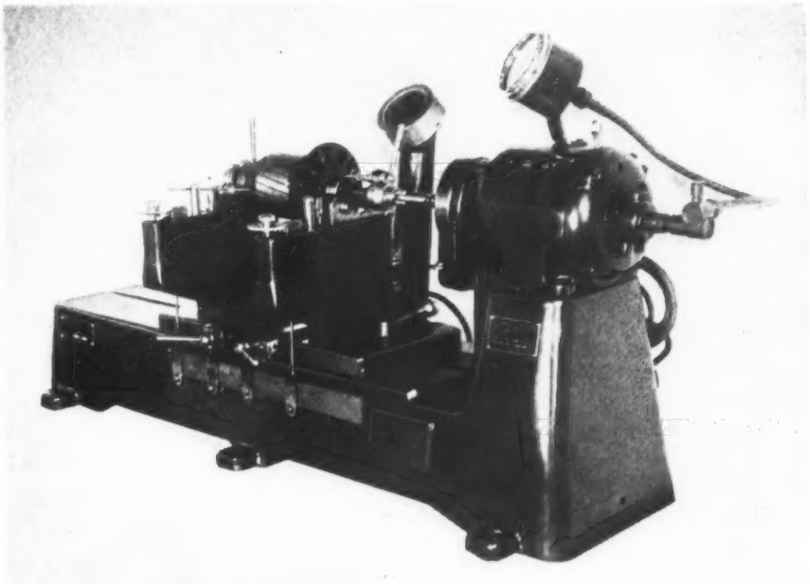
The hydraulic cylinder and piston have been designed to impart a very smooth reciprocating movement to the carriage, as required for the accurate finishing of the cylindrical walls of rifle bores, tubes, cylinders, and other long work. The honing operation consists generally of the simultaneous rotation and reciprocation of the honing tool within the bore of the work. Adjustable stroke stops provide for any length of spindle travel from 2 feet up to the full travel capacity of the machine.

A single lever controls all spindle movements, and a push-button station permits starting and stopping the motors from the operator's position. An auxiliary lever provides manual control for "short-stroking" at any point in the hone travel. A large coolant reservoir and settling tanks are contained in the work-supporting section of the bed. The long hone extension is guided by an adjustable traveling support. The driving mechanism for reciprocating the hone is completely enclosed and readily accessible. The spindle has a hydraulic cylinder and piston to actuate full hydraulic hones. Mechanical hones can also be used on the same spindle. 57

Globe Dynamic Balancing Machine

An NE-2 super-sensitive dynamic balancing machine for determining the amount and location of the corrections required to overcome the unbalance in rotating parts ranging from 5 to 50 pounds in weight is being placed on the market by the Globe Tool & Engineering Co., Dayton, Ohio. The "Micro-Indicator" dial located on the top front of each balancing head indicates and records the amount of correction required in its respective correction plane. The angular location is indicated and recorded by the "Neon-Lite" head. Approximately thirty seconds is required by the average operator to determine the condition of unbalance and the required corrections for a typical rotating piece.

The exact amount of correction required for each end can be read directly, without cross transfer. This is made possible by the "equipoise" feature, which locks out the "unbalance" in one plane while reading that in the other plane. Then, without stopping the machine, the locking point can be shifted to the first plane while reading the unbalance in the second plane. The arbor carrying the rotating work is supported by two-point contact from self-aligning ball bearings, which are adjustable to accommodate a range of shaft sizes from 3/8 inch to 1 3/8 inches in diameter. Additional sizes can be accommodated by using extra saddle adapters. The



Dynamic Balancing Machine Recently Placed on the Market by the Globe Tool & Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 160.

two-point support thus provided prevents lost motion due to tolerances or variations in shaft sizes.

The heads can be adjusted along the keyways to accommodate various lengths between bearings within a range of from 5 to 26 inches. Adjustable resonance is made possible by the external snubber springs with which a wide range of balancing speeds can be obtained. Variable speed drive is provided for the special variable-speed motor, driving through a double knuckle universal joint and chuck to the shaft. Speeds up to 5000 R.P.M. are available in an infinite number of operating steps. Smooth acceleration to any predetermined speed is made available by this arrangement.

The full line of standard dynamic balancing machines made by this company accommodates weights from 3/4 ounce to 25,000 pounds. Each model is especially designed for laboratory precision. 58

Baldwin Southwark Testing Machine

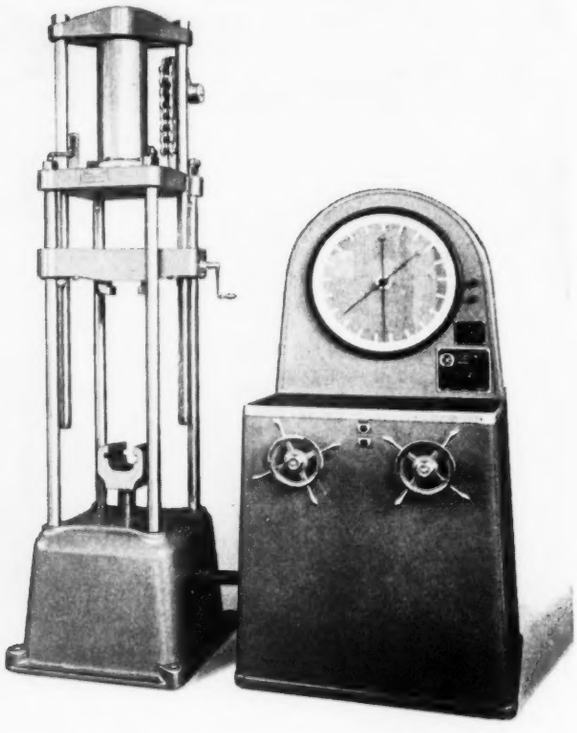
A new physical testing machine brought out by the Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa., will be on exhibition for the first time at the National Metal Congress and Exposition, Philadelphia, Pa., October 20 to 24. This new addition to the company's line of physical testing equipment is built in 20,000-pound and 60,000-pound capacities, designated Southwark-Tate-Emery Models 20-35 and 60-35, respectively. The two units are similar except for size, the smaller machine being designed especially for testing plastics, while the larger machine is built for rapid routine testing of metals. Accuracy is guaranteed to be within 3/4 of 1 per cent of the load or 0.15 of 1 per cent of the range, whichever value is greater.

The machines have lapped rams which apply the testing loads. The operating ram of each press is located at the top of the machine, and the straining yoke is carried in this ram on a ball-ended strut. Central and lower gripping heads are adjustable for convenient positioning of the test specimen. The load-indicating unit, which provides two or three dial ranges, is similar to that used on the company's larger capsule type machines, and permits instant range changing during the test. Since it employs the "null" method, or Servomotor principle, it is especially suitable to use with a recorder for making complete records of tests.

In production control work, a single operator, using a recorder-equipped 60-35 machine, can run as many as fifteen tests an hour. The recorded charts need only be blueprinted in order to supply the manufacturer and the customer with a complete record of each test. 59

Sentry Controlled-Atmosphere Furnaces

An extra deep, controlled-atmosphere, pit type furnace designated as Size 2, Model YP has recently been placed on the market by the Sentry Co., Foxboro, Mass. This furnace is similar to the one described on page 169 of May, 1941, MACHINERY, but is smaller in size. It is intended for use in hardening shorter tools or tools that require the hardening of a short end only. It permits the tools to be handled in a vertical position in the furnace, thus eliminating the tendency for them to warp or change shape. The atmosphere is produced by the use of Sentry Diamond Blocks, which give the required neutral atmosphere



Baldwin Southwark Physical Testing Machine, Built in Two Sizes

Sentry Model YP, Controlled-atmosphere, Tool-hardening Furnace

To obtain additional information on equipment described on this page, see lower part of page 160.

for heat-treating high-speed steels containing molybdenum, cobalt, or tungsten.

The furnace has a maximum rating of 16 kilowatts, with a normal operating consumption of 4 to 8 kilowatts per hour. One hour is required to heat the furnace to a temperature of 2350 degrees F. Shielded electrical terminals of a patented air-cooled design eliminate the necessity for a water-cooled terminal system. The electrical design permits direct connection to either 110- or 220-volt supply lines without the use of a transformer. The over-all dimensions are height, 36 inches; width, 28 3/8 inches; and depth, 21 1/2 inches. The muffle dimensions are 4 1/2 by 4 by 11 inches.

Another controlled-atmosphere furnace, designated Size 4, Model Y, has been added to the company's line of heat-treating furnaces. This electric hardening furnace is designed to meet the demand for a controlled-atmosphere unit for high-speed steels that will accommodate tools up to a maximum size of 4 3/4 by 4 7/8 by 11 inches. It provides controlled atmosphere suitable for any type of high-speed steel containing molybdenum, cobalt, or tungsten through the use of the Sentry Diamond Block method. It is available in two styles; one style is pedestal-mounted and has an asbestos loading shelf and wire-mesh terminal guards. The other type is fitted with legs for bench mounting, and does not have the loading shelf or guards. All other specifications are identical. The steel shelves are insulated for operation at 2500 degrees F.

The maximum rating of the furnace is 22 1/2 kilowatts, and in normal operations, current consumption ranges from 5 to 15 kilowatts per hour. The heating time from cold to a temperature of 2350 degrees F. is about seventy-five minutes. The shielded terminals and electrical contacts are air-cooled. Either type is designed for direct connection to 110- or 220-volt supply lines without the use of a transformer. 60

Gorton Engraving Machine for Munitions Work

The George Gorton Machine Co., 1316 Racine St., Racine, Wis., has developed a simplified engraving machine designed especially for munitions. This machine, known as the Model M-E munitions engraver, like the standard Gorton engraving machine, can be used to engrave or profile such parts as gun-range scales, indicator plates, gun barrels, airplane propeller pump housings, range-finder bands, gun-sight dials, gun elevation scales, and many other parts for guns, planes, ships, tanks, shells, torpedoes, etc.

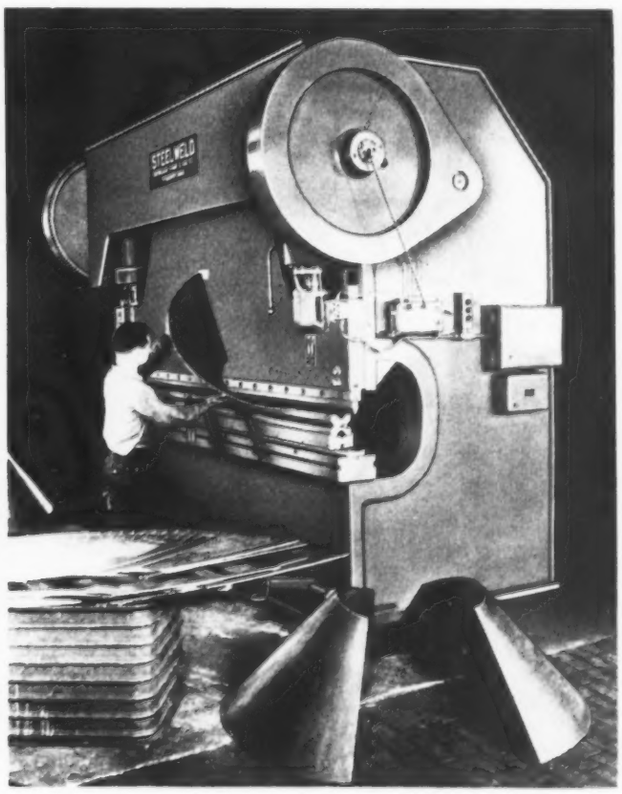
The new model is similar to the standard machines of this company's manufacture except that controls and adjustments not required for munitions work have been eliminated in order to speed up production.

The machine has an improved spindle drive of simplified design, and is provided with a fixed pantograph reduction ratio. The table is adjustable in a vertical direction only. Stock tools and accessories used with the standard engraving machines can be employed on the munitions engraver, no special equipment being required, with the possible exception of work-holding fixtures. 61

Steelweld Bending-Press Ram-Tapering Mechanism

A ram-tapering mechanism is now being furnished on the bending presses made by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co., 1157 E. 283rd St., Wickliffe, Ohio. This mechanism enables conical shapes

Engraving Machine Developed for Munitions Work by the George Gorton Machine Co.



Steelweld Bending Press with Ram Equipped for Bending Flat Sheets into Conical Shapes

To obtain additional information on equipment described on this page, see lower part of page 160.

to be produced with standard bending dies. The tapering operation is simple. The ram-tapering lever with ball-handle, shown in front of the ram in the illustration, disengages the ram clutch and permits the separate operation of the right-hand ram screw, which raises or lowers the right-hand end of the ram. With a raised or lowered position, tapering operations can be readily performed. The ram swivels on trunnions in the slides, so that there is no cramping on guides or bearings. The illustration shows a press forming two sections for the bottom of a 48-inch diameter bucket from 3/16-inch steel sheet. 62

Cross Universal Milling Machine

A No. 20 universal milling machine, with a cutter-spindle that can be adjusted to any angle in any plane, has just been brought out by the Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich. An entire series of operations can be performed on this machine with minimum handling of the work. For example, work can be milled vertically, drilled at an angle, jig-bored at another compound angle, spot-faced at a third angle, and have a horizontal keyway sunk without moving or resetting the piece.

This machine is adapted for regular milling work, for use as a universal tool on sensitive, accurate work, or as a single-purpose tool on mass production. The direct-reading spindle dial is only one of various improvements. Power feed for the table and back-gear drive for the spindle are attachments that increase the scope of the machine.

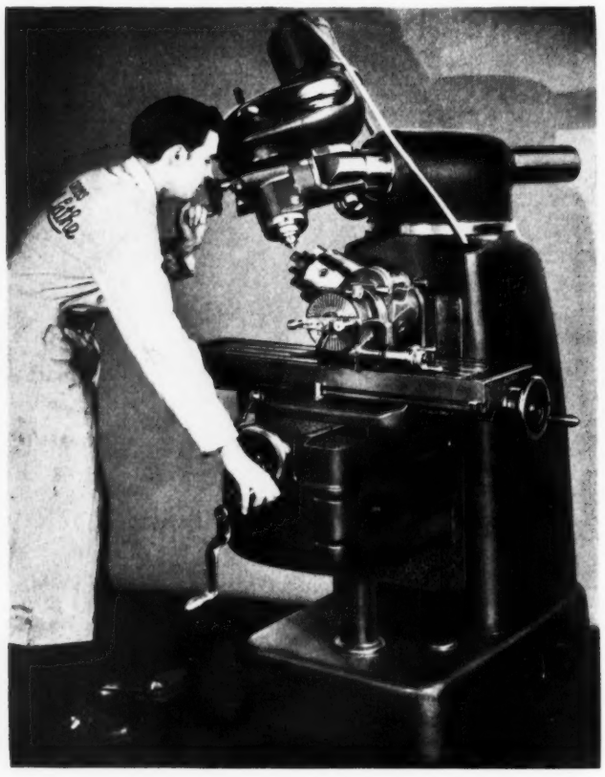
The table has a working surface of 10 1/2 by 36 inches, a longitudinal travel of 20 inches, a cross-travel of 9 inches, and a vertical knee travel of 16 1/2 inches. The maximum distance from the spindle nose to the top of the table is 16 1/2 inches, and the spindle quill travel is 4 inches. The spindle has a standard No. 3 Morse taper. The head adjustment, obtained by extending the over-arm, is 12 inches. The throat depth is 19 7/8 inches maximum and 7 7/8 inches minimum.

Six spindle speeds ranging from 350 to 3880 R.P.M. are available, with a 1200-R.P.M. motor, or six speeds ranging from 520 to 5830 R.P.M. can be obtained with an 1800-R.P.M. motor. The weight of the machine is 1750 pounds. 63

"Tocco" Surface-Hardening Machine

A two-station "Tocco Junior" electrical induction unit of 20-kilowatt capacity, for induction brazing, heating forgings, relieving stresses, soldering, and surface-hardening, has been brought out by the Ohio Crankshaft Co., 6600 Clement Ave., Cleveland, Ohio. Typical applications, in addition to surface-hardening, are brazing adapters on chemical shells, brazing collars and heads on burster tube assemblies, heating shells for forging, and heating airplane propeller hubs for shaping. This unit will be shown at the National Metal Congress and Exposition in Philadelphia, October 20 to 24.

The two rotatable transformer panels to which the inductors of this machine are fastened are similar to those of the larger machines made by this company, as are the quench and cooling water valves, automatic controls, etc. A motor-generator supplying high-frequency current at 220 volts furnishes power for the machine, which is of all-welded construction. 64



Cross Milling Machine with Cutter-spindle that can be Adjusted to Any Angle

Two-station "Tocco Junior" Electrical Induction Surface-hardening Machine

To obtain additional information on equipment described on this page, see lower part of page 160.

Deep-Hole Boring and Rifling Machines

Boring and rifling machines designated as size No. 3 have been developed by the Builders Iron Foundry, 9 Codding St., Providence, R. I., for drilling, boring, and rifling gun barrels with bores up to 105 millimeters in diameter. These machines are regularly built to handle barrels up to 156 inches in length, but they can be furnished in special sizes to accommodate longer or shorter barrels.

The drilling and boring machine, shown in Fig. 1, is of the single-spindle type, having twelve spindle speeds ranging from 20 to 375 R.P.M. and a feeding range of from 0.2 to 3 inches per minute. The diameter of the hole through the machine spindle is 4 1/2 inches. The spindle is driven by a V-belt from a four-speed motor of 5, 7 1/2, 10, or 20 H.P., and the feed is also actuated by a V-belt from a 1-H.P. motor. Quick return movement of the boring-bar carriage in either direction, at the rate of 60 inches per minute, is obtained by direct drive from a 1-H.P. motor. A 5-H.P. motor with integral pump delivers oil to the boring-bar at the rate of fifteen gallons per minute with a pressure of 500 pounds per square inch. A separate centrifugal motor pump returns the used cutting oil from the settling tank to the intake of the high-pressure pump.

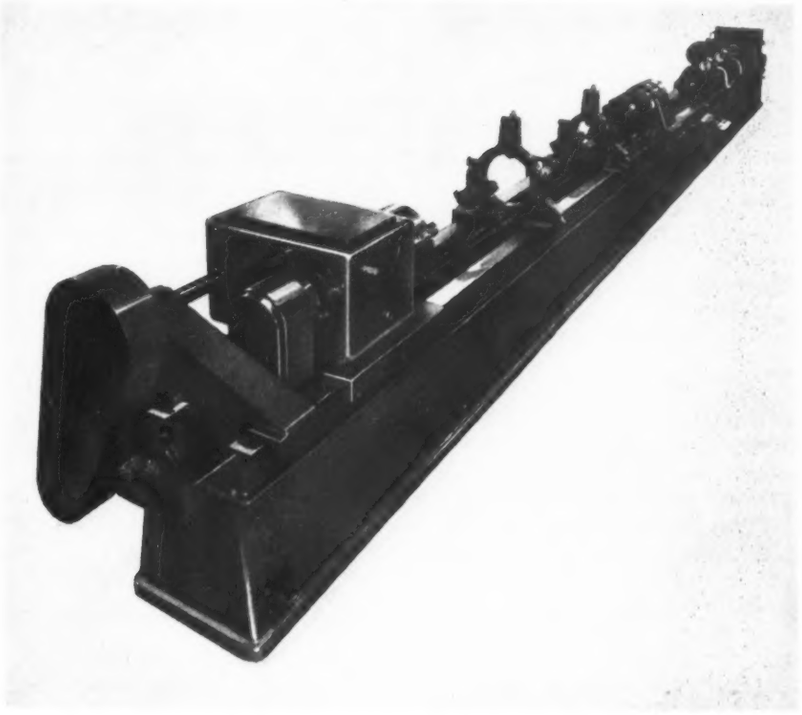


Fig. 1. Deep-hole Boring Machine Built by the Builders Iron Foundry

The machine and tools are protected against damage in case of overloads due to excessive feeds or hard spots in the work by a boring-bar holding device, which can be adjusted to release the tool in the carriage and, at the same time, open a switch that stops the spindle and feed motors should the torque on the drill or boring-bar exceed the predetermined limit.

The rifling machine, shown in Fig. 2, has a swing over the bed of 20 inches, and will handle gun barrels having a maximum diameter of 12 inches. The length of the machine bed is made to suit the barrel to be rifled. Rifling grooves of any

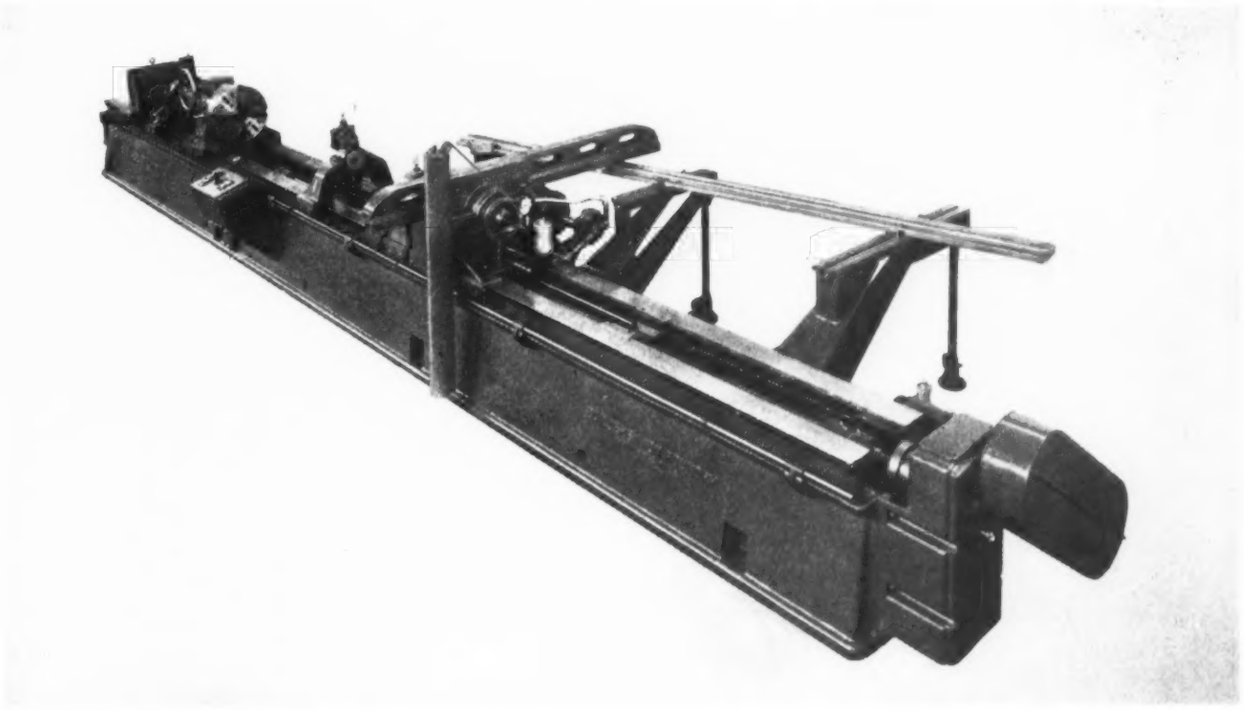


Fig. 2. Rifling Machine Brought out by the Builders Iron Foundry

To obtain additional information on equipment described on this page, see lower part of page 160.

lead from 0 to 2 1/2 turns can be cut. Three cutting speeds of 10, 15, and 20 feet per minute are available for use with push type broaches. A rapid return speed of 30 feet per minute is provided. The dividing head can be indexed manually by a handwheel through a worm and worm-wheel for cutting one, two, three, four, five, or six grooves, or multiples of these numbers.

This machine can be furnished with an adjustable sine bar for cutting a spline of any desired pitch in the rifling bar. The sine bar can be removed from the machine after splining the necessary rifling bars. The machine can then be operated either with the sine bar or with the splined rifling bar. Safety devices and guards are provided for moving parts that might cause injuries. 65

Ex-Cell-O Thread Grinder and Tool-Grinding Machine

The Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit, Mich., has just brought out two new products —a thread grinder, shown in Fig. 1, and a tool-grinding machine, illustrated in Fig. 2. The thread grinder, known as Style 39A, is designed for grinding internally threaded work and is automatic in operation. It grinds threads up to 5 inches in length within a distance of 15 1/4 inches from the work-spindle nose. The maximum size hole that can be ground is 9 1/2 inches in diameter, and the minimum size 1 inch. The maximum swing is 10 inches. An attachment is available for grinding taper threads.

This machine is one of eight standard Ex-Cell-O precision thread grinders which cover a wide range of thread-grinding work.

The heavy-duty, double-end tool grinder, designated Style 49, is designed to grind carbide tools, as well as tools made of other materials. It carries 14-inch wheels, and can be equipped for either dry or wet grinding. This grinder is the sixth and largest of the line of carbide tool grinding machines made by the company. 66

Globe Combination Universal Coil Winders

A new combination universal coil winder is being manufactured by the Globe Tool & Engineering Co., Dayton, Ohio. This coil winder permits high-speed winding with a drive connected directly to the motor shaft or high torque at lower speeds driven through a back-gear arrangement. Selections between these two drives can be made by merely shifting a lever on the gear-head.

A foot-pedal synchronizes the control of the brake, motor switch, and variable speed. Thus, simple control of speed through either of the speed ranges is obtained. Uniform acceleration from the starting point through an infinite number of steps to top speed or any desired intermediate speed is readily obtained. A turn counter registering up to 10,000 can be set to automatically stop the winder at any desired number of turns. When the predetermined number of turns has been wound, the counter, through a solenoid and suitable linkages, returns the speed control to the zero point, turns off the motor switch, and applies the brake.

This machine will accommodate wire sizes from No. 40 to No. 8, winding them into coils as large as 8 inches in diameter and 8 inches long at speeds up to 5000 R.P.M. 67

Globe Combination Universal Coil Winder

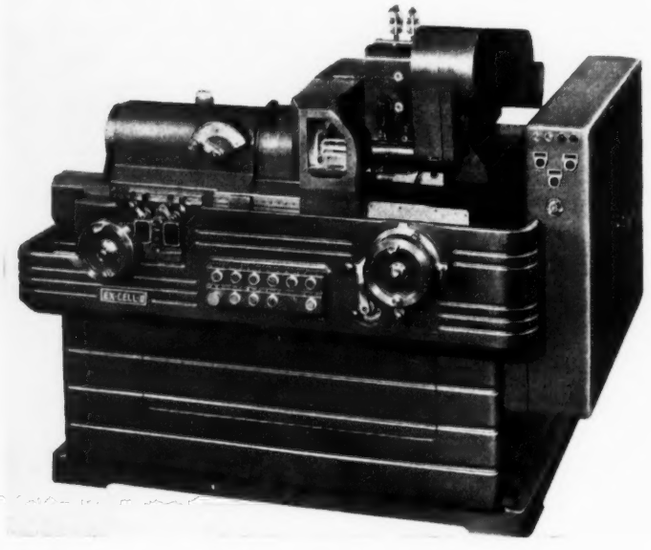


Fig. 1. Ex-Cell-O Precision Thread Grinder for Internal Work

Fig. 2. Ex-Cell-O Heavy-duty, Double-end Tool Grinder

To obtain additional information on equipment described on this page, see lower part of page 160.

Foot-operated Hydraulic Bench Vise Made by Studebaker Machine Co.

Studebaker Hydraulic Bench Vise

A hydraulic bench vise capable of developing pressures up to five tons between the jaws has been developed by the Studebaker Machine Co., 9 S. Clinton St., Chicago, Ill., to speed up small press and cutting operations, as well as vise work. The vise is operated entirely by foot control, and the unit is complete, no outside power being required to actuate the moving jaw.

Pressure to close the jaws is supplied by a foot-pedal pump mounted on a floor pedestal. A connecting steel tube carries the hydraulic fluid to a ram behind the back jaw, thus moving it forward. The front jaw is stationary. Three control pedals are provided, one of which moves the vise jaw up to the point of contact with the work; the second is then operated to apply any pressure up to five tons, and the third releases the jaw. Two sizes are available, one with a 5-inch width between jaws and the other with a 7 1/2-inch width. The vise can be mounted in a permanent horizontal or vertical position or it can be placed on a portable stand. It can also be used as a fixture on a drilling machine, shaper, miller, or grinder for use in performing a great variety of machining operations, as well as bending, straightening, testing and stamping. 68

Steele Vertical Rifle-Barrel Reaming Machine

A vertical, long-hole reaming machine designed especially for rough- and finish-reaming rifle barrels has been brought out by the W. M. Steele Co., 98 Beacon St., Worcester, Mass. This machine is of the semi-automatic type, with electrically controlled hydraulic feed, and is arranged for reaming the bore either by pushing or pulling the reamer through the barrel.

The twelve-spindle machine illustrated consists primarily of three four-spindle machines mounted in a common vertical frame. Any one of the four-spindle units can be set for a different barrel length, spindle speed, or feed, and can be stopped and started without affecting the action of the other units.

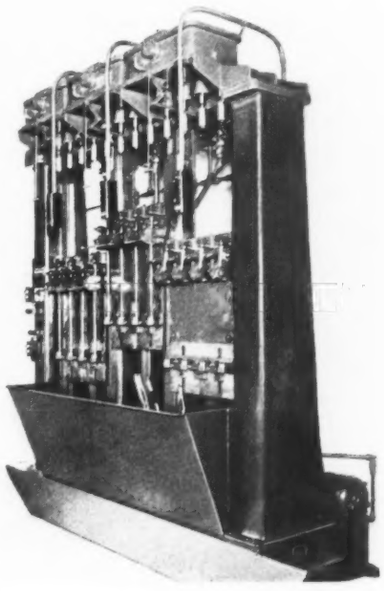
The barrels, in groups of four each, are held on the hydraulically controlled slides by a self-centering support at the bottom and a quick-acting single-stroke clamping device at the top. These holding devices can be quickly and accurately adjusted to hold different lengths and diameters of barrels.

The reamers, driven from an oil-tight gear-box at the top of the machine, are attached to the spindles either by rigid connection or by a quick-acting chuck, as desired. Coolant is pumped through the center of the hollow reamer shank to thoroughly flush the reamer.

The push-reaming cycle is as follows: First, the operator starts the cycle by pressing the start button; second, the slide carries the barrels up over the revolving reamers to the end of the reaming stroke; third, reversal is obtained by the contacting of the slide with an adjustable lug on the control bar; and fourth the slide is returned by rapid traverse to the starting point, and the machine is automatically stopped.

The pull-reaming cycle starts with the slide at the top of the machine. The reamers are inserted after the barrels are in place. Feeding is downward and reversal upward; otherwise, the cycle is the same as for push-reaming. If desired, the machine can be set to stop the slide automatically at the end of the feed stroke for removing the reamers. In any case, the reamers revolve only during the reaming stroke.

This machine is made in two sizes, the No. 1 size being adapted for reaming 0.30-caliber barrels from 22 to 28 inches long, and the No. 2 for reaming 0.50-caliber barrels from 36 to 46 inches long. 69



Rifle-barrel Reaming Machine Brought out by the W. M. Steele Co.

Bliss Two-Point, Enclosed Type Press

The two-point, enclosed type press shown in the accompanying illustration, which has a capacity of 315 tons and a distance between uprights of 84 inches, is the latest addition to the line of heavy-duty presses made by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio. The construction of the press is of

Bliss Enclosed Type Press of 315-ton Capacity

To obtain additional information on equipment described on this page, see lower part of page 160.

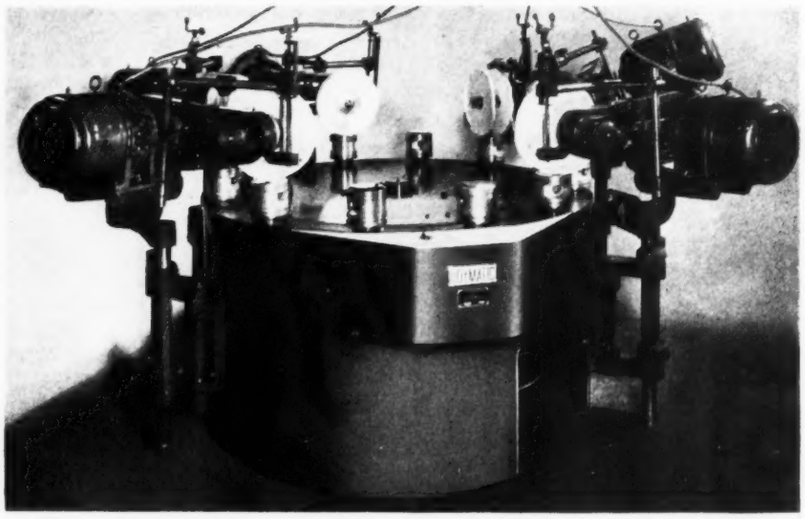
the four-piece tie-rod design. The crown, bed, slide, and uprights are steel castings. The double gearing runs in a bath of oil. This press can be furnished with a hydraulic friction clutch, hydraulic brake, and an air counterbalance. 70

Udylite Automatic Polishing Machine

The Udylite Corporation, 1651 E. Grand Blvd., Detroit, Mich., has developed an automatic polishing machine for buffing aluminum aircraft engine pistons, which is claimed to have reduced production time 97 1/2 per cent in comparison with the old method of buffing pistons by hand on a manually operated buffing lathe. This machine buffs the sides and top of a piston in 15 seconds, compared with 10 minutes by hand.

The machine has a table which is indexed automatically. Twelve chucks hold the pistons, which rotate during the buffing operation. The chucks are stationary while indexing and while loading and unloading take place. Six buffing pedestals are arranged around the machine to accommodate the buffing wheels, which are driven by a V-belt. The buffing heads have the Udylite "full-float" feature. Buffing pressure is adjustable by means of a tension spring, so that the buff rides over the work, thus providing uniform buffing pressure at all points. The wheels can be adjusted to any angle desired.

One of the principal advantages claimed for this machine is its versatility. It can be adapted to a variety of circular parts by merely changing the work-holding chucks or fixtures. Any buffing adjustment to provide proper contact with the surfaces to be finished requires but a few minutes. Only one operator is needed to load and unload the work. 71

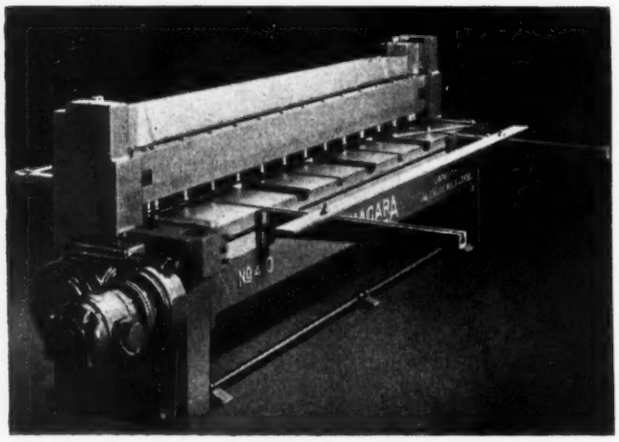


Aircraft Engine Piston Polishing Machine Developed by Udylite Corporation

Niagara Power Squaring Shears

A high degree of accuracy is claimed for a new line of power squaring shears recently brought out by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Sheared edges can be cut straight with these machines to within a few thousandths inch, and narrow strips, accurate to gage setting and parallel within close limits, are easily produced without camber or curl. Strips can be cut at the rate of 75 per minute.

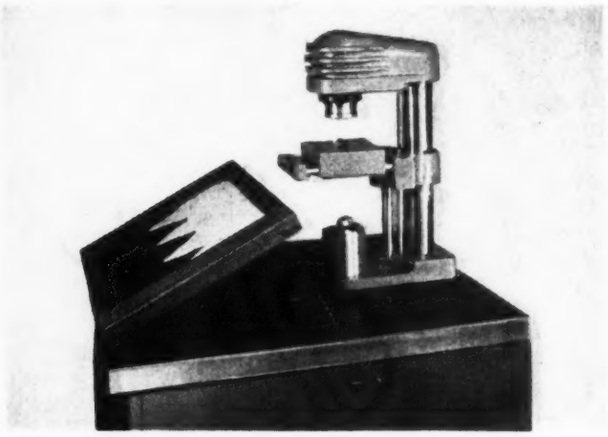
The standard equipment includes a direct-connected, three-phase, 60-cycle, 110- or 220-440-volt motor of the alternating current, splash-proof type, completely wired with magnetic starter and push-button control; a pair of knives with four cutting edges; an adjustable stainless-steel scale inlaid at each end of the bed; a front gage with front brackets; side and bevel gages; and a ball-bearing, self-measuring, parallel-operating back gage, adjustable by 1/128-inch increments. These shears have a capacity for cutting 12- to 16-gage sheet in lengths of 4 to 12 feet. 72



Niagara Power Squaring Shears

Portman Optical Projector

An optical projector adapted for use in shop, tool-room, laboratory, or production departments has just been placed on the market by the Portman Machine Tool Co., 17-19



Portman Optical Projector for Shop and Tool-room

To obtain additional information on equipment described on this page, see lower part of page 160.

Beechwood Ave., Mount Vernon, N. Y. Objects to be measured, inspected, or compared are simply placed on the work-rest of the stage, thus eliminating the need for holding fixtures.

An outstanding feature of this projector is the Acton optical system, which facilitates changing image magnifications. The projector is available with a plain type stage unit or with a coordinate type stage unit consisting of movable members for sidewise and forward travel. The coordinate stage unit includes dial type indicators, reading to 0.001 inch for rapid visual detection of object errors. The reflected image is projected on a clear or ground glass screen.

Since but one adjustment is necessary in using the projector, inexperienced operators can be employed for exacting inspections. Standard magnifications available are 10, 20, 30, 45, 60, 80, and 100. 73

Baldwin Southwark Gun-Bore Straightness Indicator

A device for indicating eccentricity in tubes and gun barrels has recently been placed on the market by the Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa. This device, known as the Haskell gun-bore straightness indicator, is a self-contained unit designed to be fitted to the ends of a gun barrel while the barrel is being straightened.

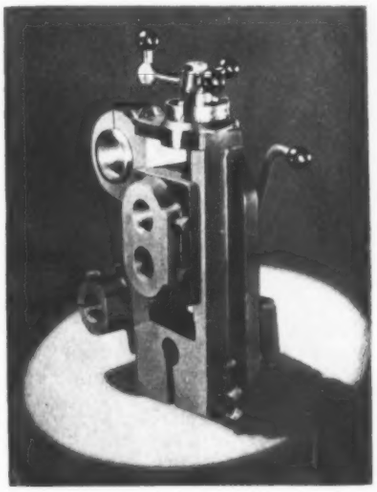
This equipment can be furnished in sizes for testing bores 37 millimeters in diameter and upward. By using extra accessories, one indicator can be employed for testing a number of bore diameters. The maximum capacity is not fixed by the instrument, but by the facilities available for handling and rotating the gun barrels.

A gun-straightening operation that formerly required half a day can be completed in a fraction of the time with the new equipment. Used with care, the device will detect an eccentricity of 0.005 inch or less. The accuracy depends on the concentricity of the roller tracks with the bore.

In operation, an induction head is moved in steps through the bore of the barrel while the latter is rotated about the head at each step. An electrical circuit is arranged to detect eccentricity of the bore by variations of the magnetic gap between the four pieces of the induction head and the wall of the tube. The equipment requires a 110-volt, 60-cycle, alternating-current power supply. Indicators are available for both cold- and hot-straightening operations, the latter for temperatures not in excess of 800 degrees F. 74

Detroit Shell Thread Gages

To meet accelerated defense production needs, the Detroit Tap and Tool Co., 8432 Butler St., Detroit, Mich., has brought out a line of high-precision thread gages for checking both internal and external threads on various sizes and types of shells. Plug gages for checking internal threads are of the reversible type, while ring gages are adjustable and can be reconditioned. As shipped, the gages are adjusted and locked in position for immediate use. 75

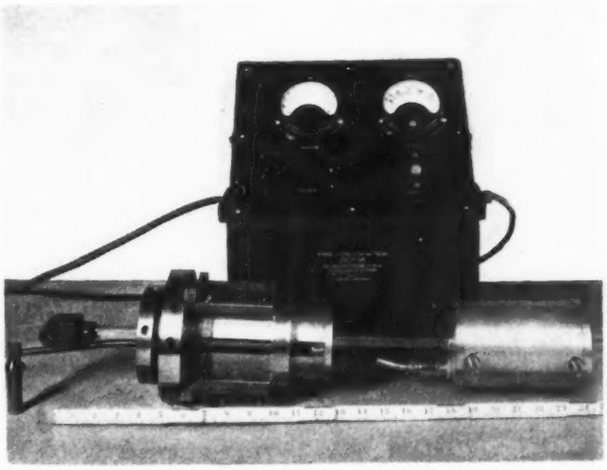


Gisholt Adjustable Turning Head for Turret Lathe

Adjustable Turning Head for Turret Lathes

A heavy-duty adjustable turning head for turret lathes has been brought out by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. This tool is designed for turning and boring work, accommodating standard cutter-holders in one of the two holes on the slide, as well as additional tool-holders in the auxiliary slide at the rear. Provision is also made for the mounting of a drill or boring-bar, together with a facing cutter.

The main slide can be quickly adjusted to size by means of a bell-crank handle fitted with a large micrometer dial. A long binder lever rigidly locks the tool-slide, permitting heavy, accurate cuts. The auxiliary slide is adjustable vertically. 76



Haskell Straightness Indicator for Tubes and Gun Barrels

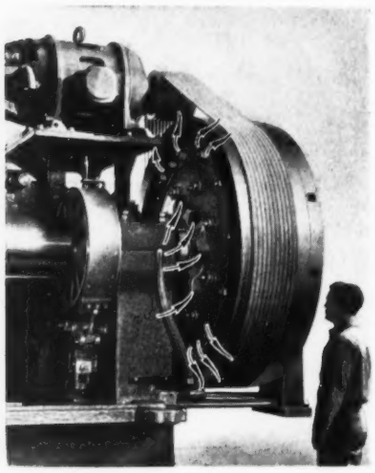
Shell Thread Gages Made by Detroit Tap and Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 160.

Ajax Air-Cooled Clutch for Forging Machines

A recent improvement incorporated in all forging machines and presses built by the Ajax Mfg. Co., Euclid Branch P.O., Cleveland, Ohio, consists of a double-draft ventilation system designed to greatly increase the efficiency of the clutch. Air in large volumes is pulled in by the scoops at the hub on both sides of the flywheel, forced out centrifugally between the friction surfaces of the clutch plates, and discharged through openings in the outer clutch housing just inside the flywheel rim, as indicated by the arrows in the accompanying illustration.

This double draft provides a generous circulation of air and ample cooling throughout the clutch, thus preventing excessive heating at highest frequency of engagement and prolonging the life of the friction surfaces. The clutch is housed within the flywheel, which is mounted between widely spaced anti-friction bearings, so that there are no overhanging torque loads. The bearings are easily accessible for lubrication and have labyrinth grease seals that prevent lubricant from entering the clutch plates. The clutch can be disassembled without disturbing the flywheel bearings. 77



Ajax Forging Machine with Improved Air-cooled Clutch

Steel Cabinet Drawer Locker Made by Standard Pressed Steel Co.

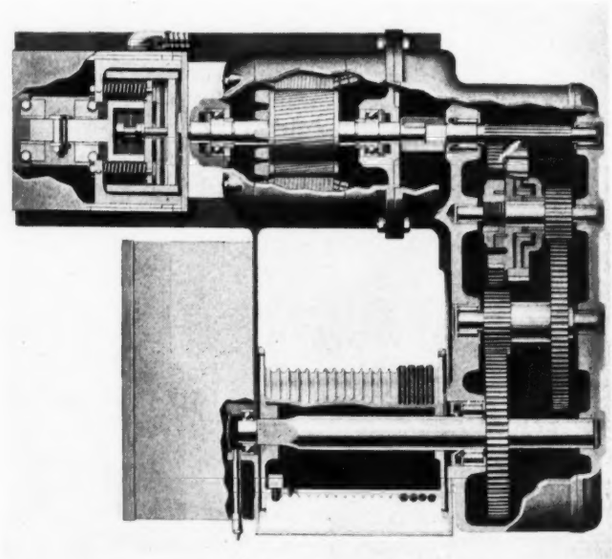
Cabinet Drawer Locker

A cabinet locker with individually locking drawers for keeping tools and equipment safe, particularly useful in plants operating in several shifts, is a new product of the Standard Pressed Steel Co., Box 22, Jenkintown, Pa. Various sizes of cabinets are available with a wide range in number of drawers. In each case, the drawer size is 20 by 20 by 6 inches. Each drawer can be supplied with a cylinder lock or provision for a padlock. The height is 52 inches. 78

Robbins & Myers Hoist

A compact steel hoist designed to occupy a minimum of head-room space has been developed by Robbins & Myers, Inc., Springfield, Ohio. The new F-1/2 hoist is built in 1000- and 2000-pound capacities, and is actuated by an R & M high-torque hoist motor. A push-button pendent switch provides single- or two-speed control for polyphase, alternating current. Provision is also made for 110-220-volt, single-phase current. The lowering speed is automatically controlled by a load brake, which also acts as an emergency brake.

The F-1/2 hoist can be applied to any make of monorail. Motor-driven trolleys with speeds of 60 to 100 feet per minute at single speed can be provided. 79



Compact Hoist Developed by Robbins & Myers, Inc.

Burgess "Vibro-Tool" Equipped for Marking or Engraving

Burgess "Vibro-Tool"

A new type of electrical hand tool operating on the vibrating principle and designed for engraving, cutting, hammering, or carving on metal, wood, linoleum, sheet rubber, sheet cork, glass, ceramics, and similar materials, has been placed on the market by Burgess Handicraft Supplies, 117 N. Wabash St., Chicago, Ill. This tool can be used to cut or engrave to a templet and to mark tools or fixtures with such information as date of purchase, ownership, etc. Dials and panels can also be readily engraved with it.

The tool makes 7200 strokes per minute, and the length of stroke is adjustable up to 1/8 inch. The accessories

To obtain additional information on equipment described on this page, see lower part of page 160.

include fine and coarse needles for engraving, tungsten-tipped needles for cutting or engraving glass and ceramic materials, knife blades, hammer tips, special cutters, and a foot gage for controlling depth of cut. 80

Whitex Pencil Tracing Cloth

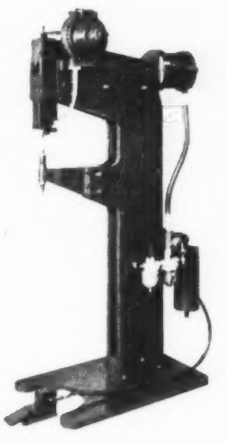
The Frederick Post Co., Box 803, Chicago, Ill., announces a new style tracing cloth known as No. 123 Whitex. It is claimed that good clear blueprints can be obtained from pencil drawings made on the specially processed, velvety surface of this tracing cloth. The cloth is tough and durable, and is said not to discolor with age. It has a glossy "stay clean" back, and its unusual transparency permits high printing speeds.

Erasures can be made quickly and cleanly with art gum or a soft eraser, and do not show on the blueprint. Pencil details do not smudge or rub off the tracing cloth. The tracing cloth will take colored pencils, giving sharp, clean lines. 81

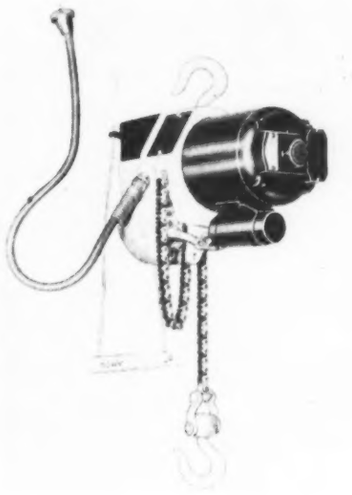
Tomkins-Johnson Rivet-Setting Machine for Use in Aircraft Industry

The development of a new type production rivet-setting machine for use in the aircraft industry has just been completed by the Tomkins-Johnson Co., Jackson, Mich. Pressure for setting the rivet is furnished by a 6-inch air cylinder operated by a recommended air pressure of 60 pounds per square inch. Less pressure can be used, however, for certain work, depending on the size of the rivet being set. The air pressure from the cylinder is applied and stepped up through a toggle mechanism. The "air squeeze" action is combined with an automatic feed feature similar to that employed on electrically driven riveting equipment.

The machine is capable of setting aluminum rivets up to 1/4 inch in diameter by 3/4 inch long. Tooling designs in some cases, however, do not permit setting maximum length rivets. The riveters are available in twelve different throat depths ranging from 9 to 36 inches, with a ram stroke of 3 inches. 82



Tomkins-Johnson Rivet-setting Machine



Westinghouse Instantaneously Reversible Motor

Instantaneously Reversible Motors

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has placed on the market a capacitor-start reversing motor for use on cranes. hoists, lathes, and many other industrial applications where instantaneous reversing is required. These motors are available in ratings of from 1/6 to 3/4 H.P., single phase, 60 cycles. They operate at 1725 R.P.M. on 115- and 230-volt circuits, no commutators being used. 83

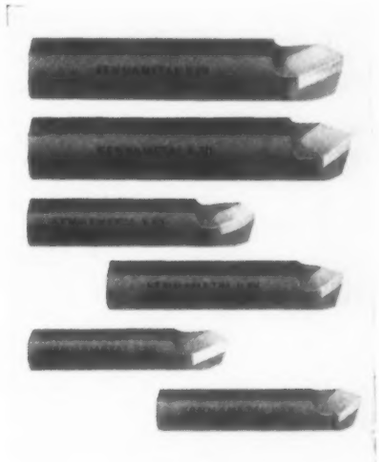
Leeds & Northrup Automatic Temperature Indicator

For taking the temperature readings of a large number of thermocouples, in any desired order, the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., has recently placed on the market the Micromax Model S self-balancing indicator. As many as fifty thermo-couples can be connected to one indicator, and individual readings of each couple are rapidly taken by simply throwing the proper toggle switch at the front of the instrument. Each switch is a double-throw, non-locking type, which connects the indicator to either of two couples and returns to neutral position automatically when released. Readings are taken on a clearly graduated scale, 9 7/8 inches long, with graduations available in a wide choice of ranges. 84

Automatic Temperature Indicator Made by Leeds & Northrup Co.

Kennametal Boring Tools with Round Shanks

A new series of standard Kennametal boring tools with round shanks, designated 27-R and 29-R, will be exhibited at the National Metal Congress and Exposition, Philadelphia, Pa., October 20 to 24, by the McKenna Metals Co., 147



Various Sizes of Kennametal Styles 27-R and 29-R Boring Tools

To obtain additional information on equipment described on this page, see lower part of page 160.

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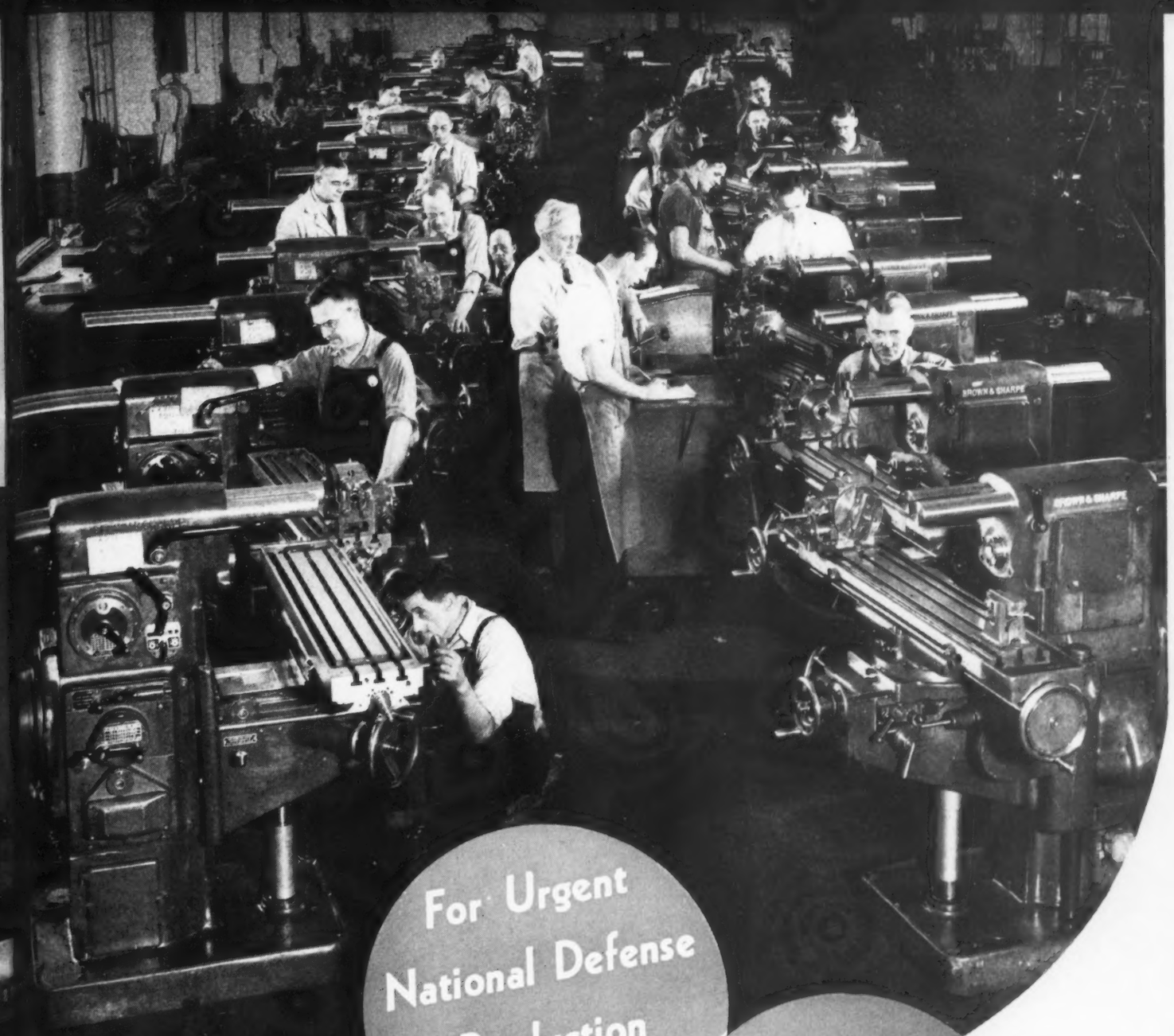
COLUMN and KNEE MACHINES

for the increased variety of milling demands

BROWN &



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Know the many productive features on Brown & Sharpe Milling Machines — just ask for detailed specifications — Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

B·S

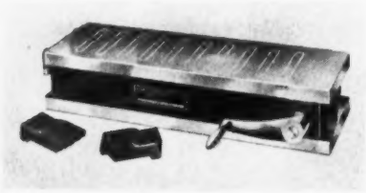
SHARPE

Lloyd Ave., Latrobe, Pa. These new tools have the same cutting angles as other standard Kennametal boring tools, including the 12-degree positive back rake designed to compensate for the negative effect from holding the tool at one-half the height of the shank above center.

The Style 27-R tool is intended for use in 30-degree boring-bars, and the Style 29-R tool in 45-degree boring-bars. They are supplied in common shank sizes, the tolerance on the round shanks being plus 0.000 and minus 0.001 inch. Both styles of tools are tipped either with Kennametal grade KM for machining steel or with Kennametal grade K3H, a very hard grade used for precision boring and finishing cuts of all types. 85

B & S Large-Size Permanent Magnet Chuck

The Brown & Sharpe Mfg. Co., Providence, R. I., has just added to its line of equipment a large-size,



Large-sized Magnetic Chuck Made by Brown & Sharpe Mfg. Co.

rectangular, permanent-magnet type of chuck, designated No. 1236. While this chuck is similar in design to a previous model brought out by the company, it is of unusually large size, having a working surface of 12 1/8 by 36 inches, with a magnetic surface of approximately 9 1/2 by 29 5/16 inches. The over-all height of the chuck is 4 7/8 inches; the over-all length, including the handle, is 41 13/16 inches; and the over-all width is 16 11/16 inches. This chuck is especially suitable for heavy grinding and slabbing work.

A rectangular model magnetic chuck of the permanent-magnet type (the No. 618H), which has a hardened top plate, has also been added to the line of chucks made by this company. The hardened top plate makes this chuck especially adapted for handling various types of work that might score or mar the surface of a regular chuck. These two chucks are for sale only in this country and its territories. 86

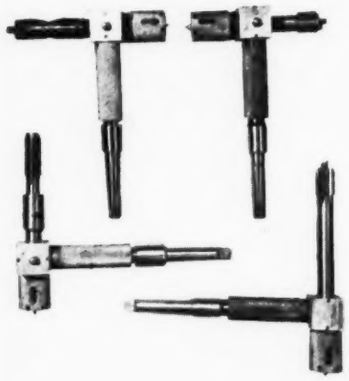


Fig. 1. Angle-tool Attachments for Portable Drills

Angle-Tool Attachments for Portable Drills

The Invincible Tool Co., 914 Citizens Trust Bldg., Fort Wayne, Ind., is manufacturing a complete line of angle-tool attachments designed to adapt portable drills for universal operation in close corners and narrow spaces. The various attachments of this line cover a range of drilling capacities from 3/16 inch to 3 inches.

Drilling, reaming, tapping, nut-running, counterboring, spot-facing, countersinking, screwdriving, vertical and angular milling, boring, grinding, etc., are some of the operations for which the attachments can be used. They are especially intended for use in machine repair work, installation of machinery, assembling Diesel engines, pumps, turbines, and generators, and in ship and aircraft construction. 87

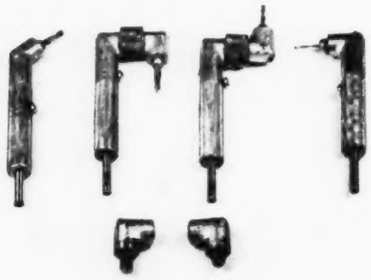


Fig. 2. Attachments for Drilling in Small Spaces and Corners

Hobart Arc-Welder

A specially designed arc-welder for aircraft construction has been placed on the market by Hobart Brothers Co., Troy, Ohio, under the trade name "Aircraft Special." This welder embodies the same design and operating speed as other Hobart Multi-Range arc-welders, but has been modified to give the quick, hot start necessary in welding light-gage tubular members in airplane construction. It also provides a lower range of welding current — from 10 to 150 amperes at normal welding voltage. The machine is especially intended for all light-gage metals that are weldable by the electric arc, including the welding of X-4130 chromium-molybdenum steel. 88

DoAll Mitering Attachment

A mitering attachment designed to facilitate metal-ripping, cutting-off, and mitering operations on DoAll machines has been brought out by Continental Machines, Inc., 1312 S. Washington Ave., Minneapolis, Minn. These three operations can be performed on a single unit adapted to either manual or power feed. The attachment can be quickly mounted on the work-table for use in notching, squaring, ripping, and mitering rods, tubing, bars, gates, channels, rails, and irregular shapes.

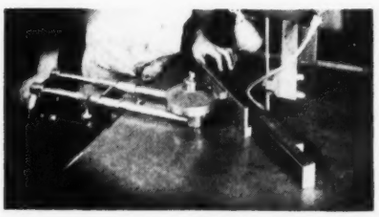


Fig. 1. DoAll Machine Equipped with Mitering Attachment

The mitering head is attached to slide-rods and carried by the slide-rod bracket mounted on the guide.

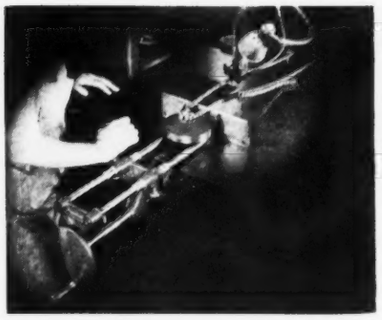
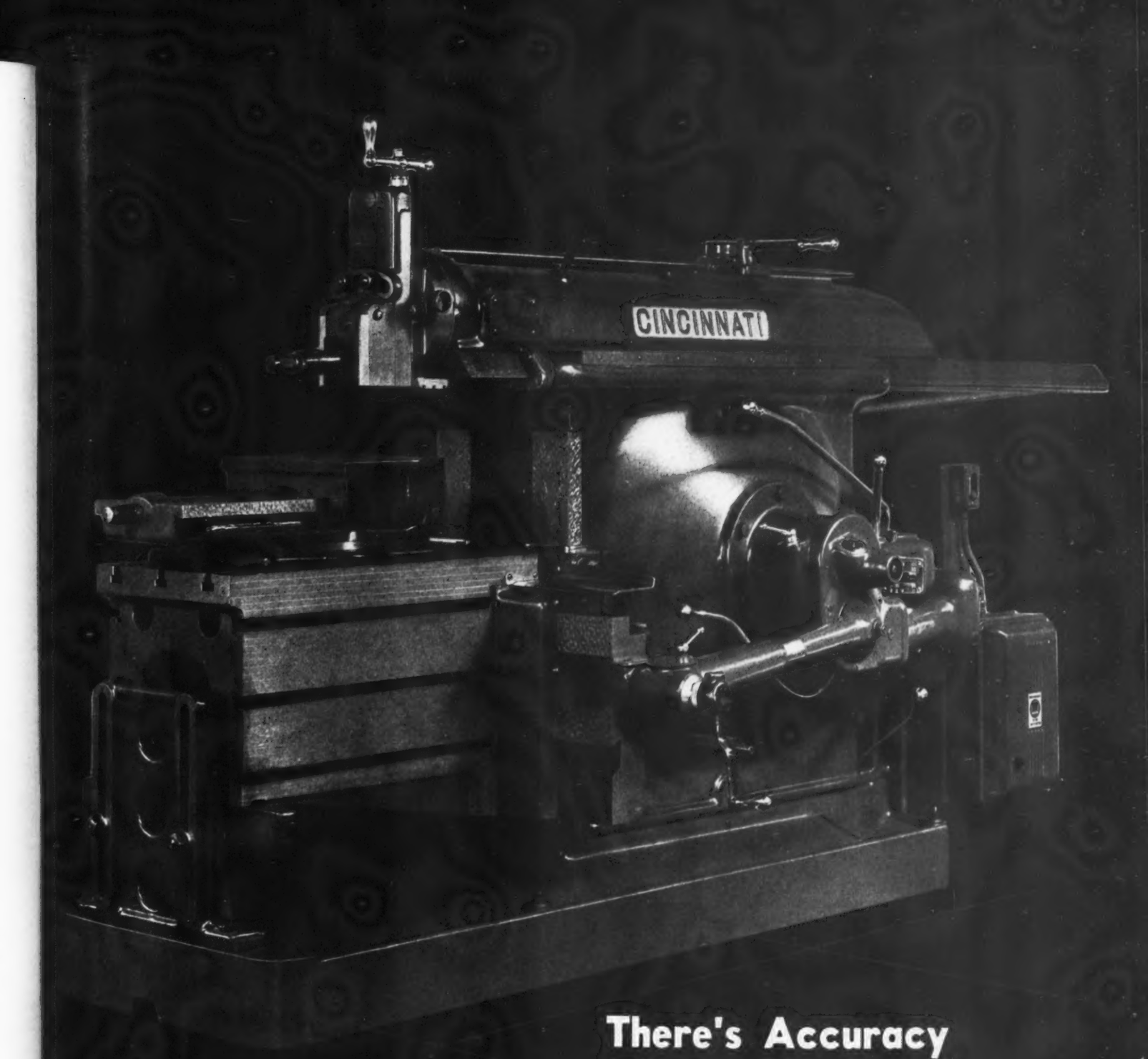


Fig. 2. Mitering Attachment Shown in Fig. 1 Used for Cutting off with Power Feed

To obtain additional information on equipment described on this page, see lower part of page 160.



There's Accuracy Where Cincinnati Shapers Work

Always the handy shaping tool—in its present highly developed form the shaper has taken on a new importance. For many planing jobs, for tool room and die work the Shaper is indispensable. Cincinnati accuracy has been considered a standard for more than 40 years.

16" to 36" Stroke
Plain or Universal Table

Write for Catalog N-1

THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES
CINCINNATI, OHIO.

Manual operation is accomplished by a 6-inch handwheel through a screw which engages an internally threaded tube on the slide-rod bracket for feeding the mitering head directly toward the saw, as shown in Fig. 1. Power feeding merely requires the disengaging of the internally threaded tube. 89

Air-operated Impact Wrench Made by Ingersoll-Rand Co.

Air-Operated Impact Wrench

An impact wrench, known as Size 508, which utilizes the patented "Pott Impact Wrench" principle developed to localize the steel-to-steel impact without transmitting shock to other parts of the tool, has been placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York City. The average working speed at ninety pounds pressure is 850 R.P.M.; the weight is 8 1/2 pounds; and the length without the chuck is 10 13/16 inches. It is recommended for applying and removing nuts up to the 5/8-inch bolt size. The form-fitting pistol grip has a trigger type throttle. 90

Protractor Type Cutting Torch Holder

Convenience and accuracy in setting Radiagraph cutting torches to any desired angle of cut are provided by a protractor type torch-holder made by the Air Reduction Sales Co., 60 E. 42nd St., New York City. The new holder, which can be attached to any standard Airco Radiagraph cutting torch, has a circular knurled knob for controlling the angular adjustment through a 90-degree range. The accompanying photograph shows the holder set for cutting a bevel on a billet. 91

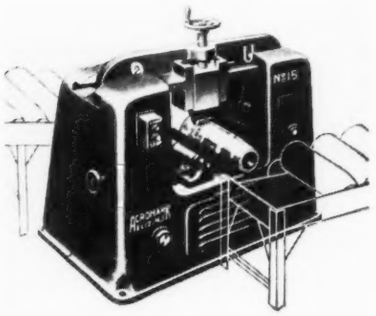
Surface Plate Made by South Bend Tool & Die Co.

Large-Size Surface Plate for Shops and Tool-Rooms

A large surface plate, 4 feet wide by 8 feet long, cast in semi-steel and finished plane within 0.005 inch is being offered as a standardized product for machine shops and large tool-rooms by the South Bend Tool & Die Co., 2000 S. Main St., South Bend, Ind. Two sizes of adjustable blocks or legs (10- and 12-inch) provide a range of working surface heights between 29 and 33 inches. The blocks support 1 1/2-inch screws, each topped with a recessed circular cap in which any of the projecting support points on the bottom of the plate can be placed. A 12-pitch thread provides fine adjustment to compensate for floor irregularities, slope, etc. Five of these supporting blocks are provided with each surface plate. The surface plate weighs 3 tons. 92

Shell-Marking Machine

A new marking machine—the No. 15—has been developed by the Acromark Corporation, 251-257 N. Broad St., Elizabeth, N. J., for high-production shell-marking. The shells can be fed to this machine from a truck or conveyor by a specially designed arrangement that automatically slides them onto ball-bearing cradle rolls. Straight-line flat dies or type, in a heavy reciprocating slide, marks a shell at each forward or backward stroke by rotating it on the cradle rolls. The depth of marking can be adjusted by a handwheel. Various sizes of shells can be accommodated by changing the cradle and rolls. The machine is self-contained, a push-button controlled motor being mounted inside the housing. 93



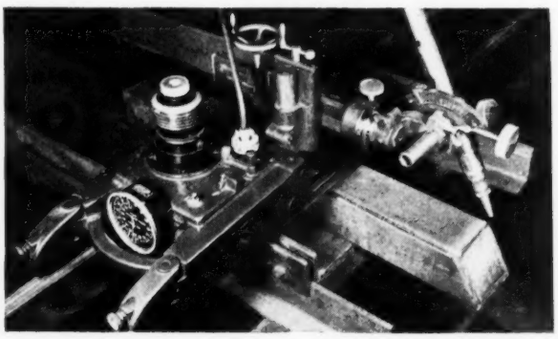
Acromark Shell-marking Machine Adapted for a Variety of Work

* * *

Expansion of the Oakite Research Laboratories

The metals section of the research laboratories of Oakite Products, Inc., 22 Thames St., New York City, has been expanded to a point where it provides complete facilities for reproducing, on a pilot-plant scale, actual production conditions such as are generally found in metal-plating and fabricating plants. With the expansion of this metal-plating laboratory and the installation of the required equipment, it is possible to control the composition of the cleaning solution, the current density, the timing of the cycles, the soil loading, and other variables encountered in metal-plating and finishing practice.

One of the objectives in developing this research laboratory was to enable the service representatives of the company to give greater technical service and closer cooperation in connection with any production problem in the preparation of metals for electroplating or other finishing operations. This is of especial importance due to industrial expansion.



Protractor Type Holder for Cutting Torch, Made by Air Reduction Sales Co.

To obtain additional information on equipment described on this page, see lower part of page 160.

CINCINNATI BICKFORD

SUPER SERVICE RADIAL

is the most accurate and easily handled Radial Drill we ever used . . .

—STATEMENT BY THE BELL AIRCRAFT CORP., BUFFALO, N. Y.

The above statement by the Bell Aircraft Corporation refers to countless advantages derived from the Super Service Radial. In this important Defense plant the Radial illustrated is used primarily for jobs on tools and fixtures where accuracy, speed and ease of handling are advantages of extreme value. Applied to many such operations—and more generally to quantity production—the numerous Cincinnati Bickford Super Service Radials in service today are proving their value as one of America's leading Tools for Defense. Bulletin R-21-A lists all features and gives complete details.

INSERT: A typical heavy duty job calling for close Aircraft precision for which the Super Service Radial is ideally suited.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

Design and Use of Carbide-Tipped Tools

By C. G. WILLIAMS
Consulting Engineer, Davenport, Iowa

THE author of the article on page 105 of August MACHINERY, "Carbide-Tipped Tools for Boring Operations," should be commended for advocating placing the boring tools above center, as this permits less clearance to be used at the front of the tool than would be necessary were the tool placed on or below the center line.

Some designers hold that a boring tool should be placed on the center or below; when that is done with carbide-tipped tools, the tip will not have a long life. In one well-known plant, the boring tools used on the cylinder barrel of an aircraft engine are placed 3/16 inch below center. The carbide-tipped tools break by the thousands; much of the blame is laid to the design of the tools and holders rather than to their location below center.

In commenting on the article in August MACHINERY, the writer disagrees in regard to placing the tool slot at 90 degrees to the axis of the bar; he believes that it should always be placed at an angle of 45 degrees to obtain the best results. The use of a 45-degree angle will allow a longer tool to be used; and on the larger boring-bars that generally take heavier cuts, two set-screws can be used on the tool to hold it more firmly and reduce vibration.

The writer has used carbide-tipped tools ever since they were first introduced into this country in October, 1927, when, at a local meeting of the American Society of Mechanical Engineers, he was given three sample tools tipped with Widia. He, therefore, has had a great deal of experience with these tools.

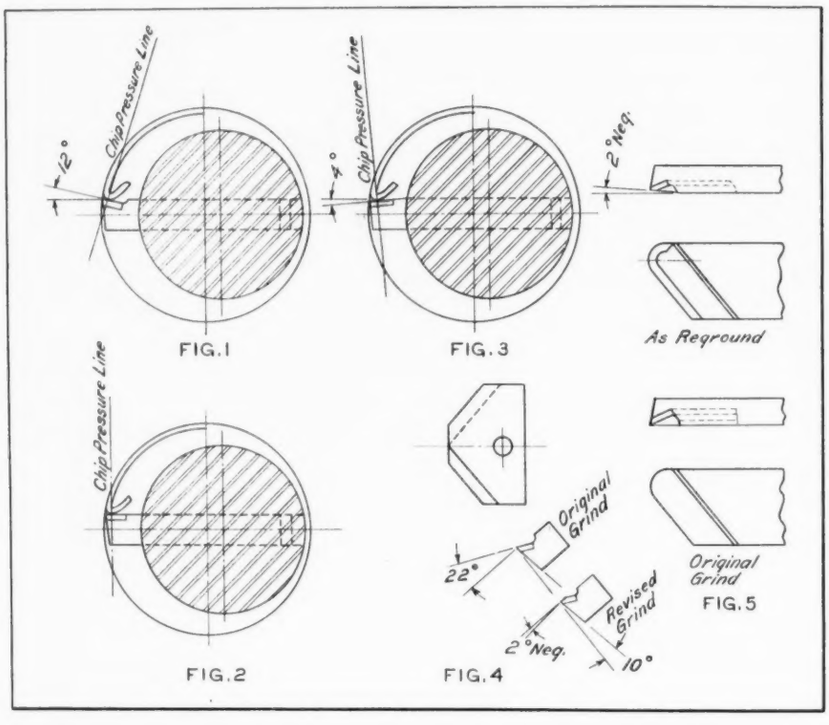
Sintered carbides are not homogeneous materials like steel, but have more the nature of a ceramic material—brick, for example—in that they are composed of very fine particles of the hard substance carbide, held together by a binder, generally cobalt, although sometimes nickel, molybdenum, or an alloy of nickel and molybdenum is also used. Cobalt is generally chosen because of its heat-resisting qualities rather than its strength.

Because of this nature of carbides, their cutting edges cannot be ground. The edge must be thicker, and better supported, than on a high-speed steel tool, and less clearance must be used.

One complaint of many users is that they cannot put a keen edge on the tool. The same complaint was made of high-speed steel when it was first introduced. The reason that one cannot get a fine edge on a carbide tool and hold it is that the carbide itself is ball-milled to 200 mesh fineness or finer; therefore, the finest edge obtainable on a tool is dependent upon the size of the average particle of carbide, which is about 0.0005 inch.

There is no known substance that will cut these carbides. The diamond cannot cut them. In grinding, the wheel only removes the binder and displaces the carbide grains. This is one of the reasons why carbide-tipped tools cannot be ground in the same way as high-speed steel tools. Owing to the fact that steel is homogeneous and tough, large clearance angles and back rake angles can be used; but because of the nature of carbide tools, their life is reduced by trying to use large clearance and back rake angles. One of the makers of cemented-carbide tools, in fact, uses a negative back and side rake in many cases, with the best of results.

The author of the article referred to goes to the opposite extreme and advocates a 12-degree positive back rake on boring tools. Let us see what happens when this is done. In Fig. 1, the angle of chip pressure on the tip would be about 90 degrees, or perhaps, between 85 and 90 degrees. This pressure would not only have a tendency to break off the cutting edge, but would also tend to pull the tip loose from the shank. When the tip is set parallel with the top of the tool shank, as in Fig. 2, the chip pressure is still nearly perpendicular to the surface of the tip, but, obviously, the construction produces a stronger cutting edge. If a slight negative rake, as in Fig. 3, is used, the pressure is toward the shank and the liability of breaking the cutting edge is minimized still further. Also, the tip is forced back into the cavity and there is no tendency to pull the



Figs. 1 to 5. Illustrations Showing Various Methods of Grinding Carbide Boring Tools

PRECISION PRODUCTION

. . . — *vital to* VICTORY

The swift and gigantic steps that American industry is taking in the program for national security are largely due to the *precision production* of metal parts. When the present emergency is ended, the record will show that one of the outstanding accomplishments was the production of defense material, not only in stupendous quantities but with each vital metal part repeatedly held to an extremely high standard of accuracy in size and finish. Today, in the midst of this emergency, Ex-Cell-O standard machine tools are performing numerous precision jobs in practically every industry engaged in defense work. They are taking an important part in making possible the speed and accuracy upon which success depends.

Illustrated here is an aircraft part being bored on Ex-Cell-O Precision Boring Machine (Style 112-C) with Ex-Cell-O Universal Fixture. Standard Ex-Cell-O Boring Machines are used extensively in production because of their ability to hold extreme accuracy in size and finish.

Picture below shows one of many precision parts being produced for airplanes on Ex-Cell-O Standard Thread Grinding Machines (Style 31 is shown here). Precision thread grinding is now universally employed in the production of all vital threaded parts used in aircraft.

The plane illustrated to the left is the Curtiss P-40, a single seat low wing pursuit plane, many of which are being produced daily by the Curtiss-Wright Corporation. Ex-Cell-O precision machines, producing close-limit aircraft parts for this plane, are shown above.

EX-CELL-O
CORPORATION

DETROIT
MICH.

XLO

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

tip away from the shank or dislodge it.

Perhaps it should be added that the use of a positive back rake on carbide-tipped tools is apparently the result of experience with carbon steel and high-speed steel tools. It is the reason that some users of carbide-tipped tools are breaking them in great numbers.

Referring to the illustration on page 106 of August MACHINERY, and to the illustrations accompanying this article, the writer would say that Fig. 4 in the former article shows his idea of a tool for boring to a 90-degree shoulder; but in the example shown in Fig. 5 of the same article, the writer would use a 58- to 62-degree side-clearance edge angle, instead of the 55-degree angle shown there. The 58- to 62-degree angle would give more nearly the shear cut that most users of tools need. In this case, no positive back rake at all should be used, but a flat tip. Again, if the cut is quite heavy or the material is heat-treated to 180 Brinell or above, a 2- to 4-degree negative rake is advocated to insure long life between grinds.

To summarize, because of the nature of carbides and the tendency of the material to break off at the edge, a negative rake will give a longer life between grinds than may be expected from a tool ground with a positive back rake. This applies to the cutting of all heat-treated steels. There are also occasions when a negative back rake would be efficient on a carbide-tipped tool used in cutting brass or aluminum to prevent the tool from digging in. The writer has known carbide-tipped tools made with a 22-degree positive back rake cutting brass or aluminum that were not a success until they were reground with a 2-degree negative rake, after which they ran for two months without grinding. (See Figs. 4 and 5.)

Now, the writer would not say that a negative rake will solve all troubles in machining hard substances, for it is seldom that the job does not require some change in tool grinding to give the best results; but he would say that he has never seen a tool ground with a top rake that had the cutting life of a tool with a flat top, parallel with the top of the tool shank.

Giddings & Lewis Places New Emergency Plant in Operation

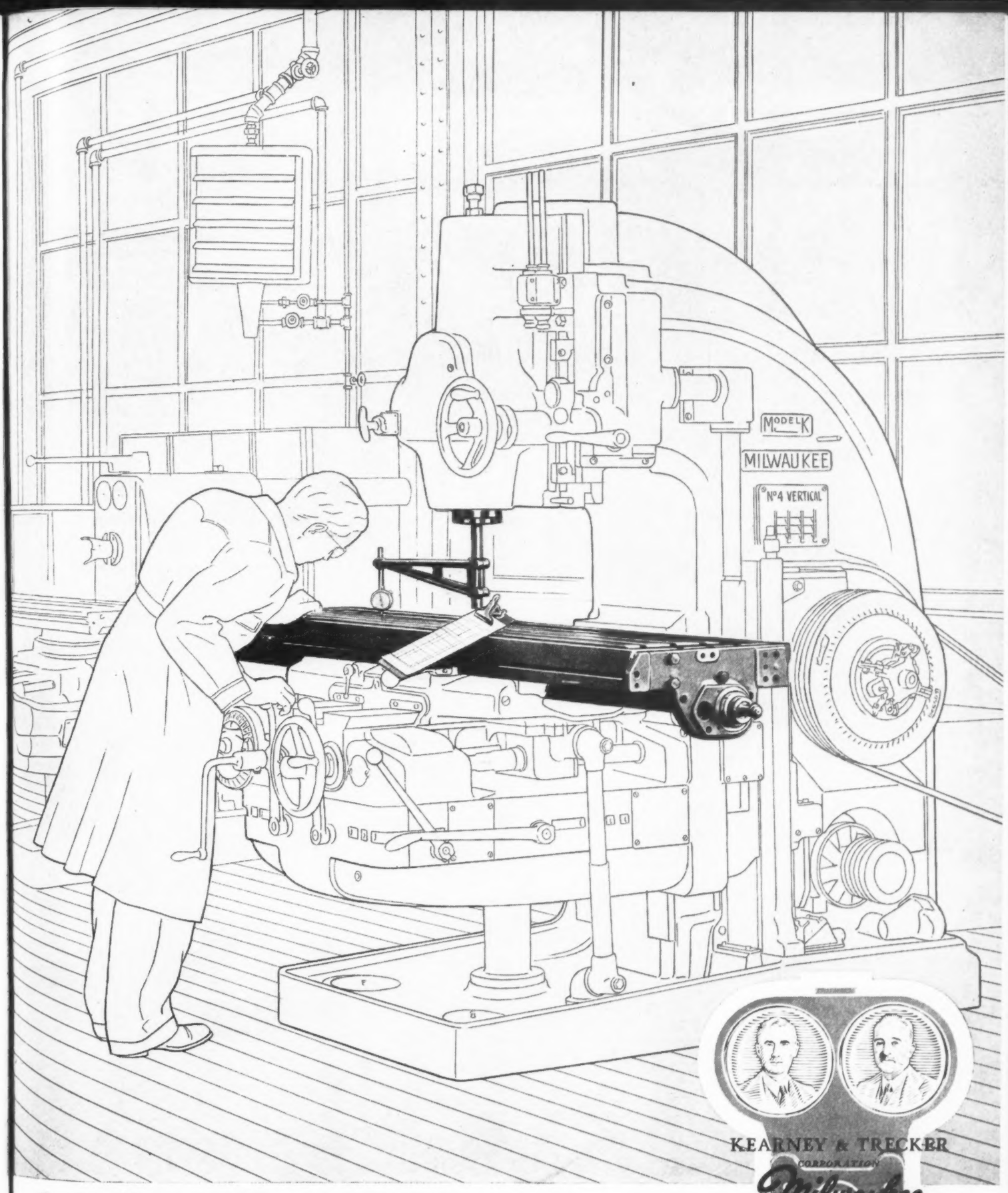
On August 27, the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., celebrated the official opening of the emergency plant constructed last spring in cooperation with the War Department. The first machine was also shipped at that time from this plant. Colonel Donald Armstrong, executive officer of the Chicago Ordnance District, represented the War Department. Many members of his staff were also present, as well as men prominent in the state and federal governments and industrial leaders.

The Giddings & Lewis Machine Tool Co. was asked by the Government last November to triple its capacity. Ground was broken for an expansion of the company's own plant in December, all the buildings of which were completed by February. This plant was in operation by the end of March. The second phase of the program involved the construction of a complete separate plant under the Emergency Plant Facilities provisions. This was started in January; the building was completed in April, and most of the machine tool equipment was in operation by the end of May. The entire program involves an expenditure of approximately $10,000,000. The first large machine from the emergency plant was ready for delivery at the time of the celebration of the official opening of the plant.

* * *

Machine tool shipments in August totalling $64,300,000 were the highest on record in the history of the industry, according to the National Machine Tool Builders' Association.

Interior View of the New Plant Erected by the Giddings & Lewis Machine Tool Co. to Provide Facilities for Producing Horizontal Boring, Drilling, and Milling Machines for the Defense Program



"Squaring table top with spindle" . . . one of many precise alignment checks made on *Every* Milwaukee Milling Machine.

KEARNEY & TRECKER CORPORATION
Milwaukee
MILLING MACHINES

Milwaukee MILLING MACHINES

NEWS OF THE INDUSTRY

Connecticut

EUGENE E. EVERETT, formerly process engineer and metallurgist with the Muncie Gear Works, Muncie, Ind., has joined the A. F. Holden Co., New Haven, Conn., in the same capacity.

VICTOR A. HANSON has been appointed general sales manager of the Whitney Chain & Mfg. Co., Hartford, Conn. Mr. Hanson was formerly assistant sales manager and field manager.

Illinois

RAY P. TENNES, who has served as a director and secretary-treasurer of the Shafer Bearing Corporation, Chicago, Ill., for the last seven years, has been elected chairman of the board of directors. Mr. Tennes succeeds his father, the late M. J. Tennes, Sr., who had served as chairman of the board since 1930. Ray P. Tennes is the eldest of the three sons, all of whom are officers and directors of the corporation. In addition to serving as chairman of the board, Mr. Tennes will continue to hold the position of treasurer. W. L. KINNAW, comptroller of the corporation, has been elected assistant treasurer and assistant secretary. M. J. TENNES, JR., who is president of the corporation, is now on leave of absence, serving as Captain in the U. S. Army Air Corps. J. F. DITZELL is vice-president and general manager.

DOALL CO., INC., Des Plaines, Ill., manufacturer of metal-cutting band saws for contour sawing, announces that, in accordance with the ruling of the Office of Production Management on August 20, DoAll band saws will be made in the future in the forty-two standardized sizes authorized. No other sizes can be supplied without the approval of the Office of Production Management.

OTTO W. WINTER will assume the duties of vice-president in charge of manufacturing of the REPUBLIC DRILL & TOOL CO., Chicago, Ill., a newly organized manufacturer of high-speed twist drills, employing 300 workers. Mr. Winter is also a member of the board of directors. For the last four years, he has served as factory manager of the Columbus McKinnon Chain Corporation and its subsidiary, the Chisholm Moore Hoist Corporation, Tonawanda, N. Y. Mr. Winter is first vice-president of the American Society of Tool Engineers and national chairman of that Society's Emergency Defense Training Committee. He is also a member of the American Society for Metals, American Welding Society, Society of American Military Engineers, and American Society of Safety Engineers.

Otto W. Winter, Vice-president in Charge of Manufacturing of Republic Drill & Tool Co.

SHELDON MACHINE CO., INC., manufacturer of precision lathes, arbor presses, and vises, announces that it is now located in its new factory at 4240-4258 N. Knox Ave., Chicago, Ill.

Indiana

W. K. MILLHOLLAND MACHINERY CO., 1048 Fairfield Ave., Indianapolis, Ind., Machinery Sales Division, has been appointed sales agent in the Indiana territory for the MURCHEY MACHINE & TOOL CO., Detroit, Mich., manufacturer of die-heads, chasers, taps, planetary thread millers, and threading machines. The Millholland Company also designs and builds special production machinery.

HARRY G. JOHNSON has been appointed salesman in the Indianapolis territory for Manning, Maxwell & Moore, Inc., Bridgeport, Conn., in place of GERALD BEEBE, who has been extended a leave of absence due to illness. Mr. Johnson will handle the sales for the products of all four of the Bridgeport divisions, including valves, gages, and industrial instruments.

Michigan

J. HUGO SMITH, familiarly known as "Pop" to his employes, has retired as president of the Wesson Co., Detroit, Mich., manufacturer of tungsten-carbide and high-speed cutting tools. The business was founded by Mr. Smith twenty years ago in a small garage. Two hundred of the employes gave a farewell party to the retiring president on September 6, and presented him with a 6-foot model of the old tea-trade sailing vessel *The Southern Cross* and a plaque inscribed "In memory of bygone days. To J. H. Smith from the boys of the Wesson Co."

BALLE ENGINEERING PRODUCTS CO., 9730 Grinnell Ave., Detroit, Mich., designer and maker of special machinery, tools, fixtures, gages, and dies, has moved into its own new and modern building, where a large staff of tool engineers are employed to serve the company's customers.

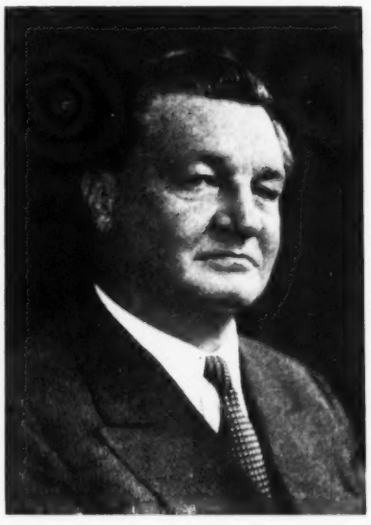
DETROIT BROACH CO. has moved into its new plant on Sherwood Ave. near Eight Mile Road, Detroit, Mich. This triples the company's former floor area and provides greatly increased production facilities.

KENNETH R. BLAKE has been appointed chief engineer of the Kaydon Engineering Corporation, Muskegon, Mich., manufacturer of special bearings and equipment. Mr. Blake was previously consulting engineer and technical adviser for a number of firms in the machinery industry.

New York

LAWRENCE K. BLACKMAN, assistant treasurer of Farrel-Birmingham Co., Inc., Buffalo, N. Y., retired from active service on September 1 after having been connected for forty-three years with the company.

FRED H. HAGGERSON was elected a director of the Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City, at a recent meeting of the board of directors. Mr. Haggerson is a vice-president of the Union Carbide



Fred H. Haggerson, Newly Elected Director of the Union Carbide and Carbon Corporation

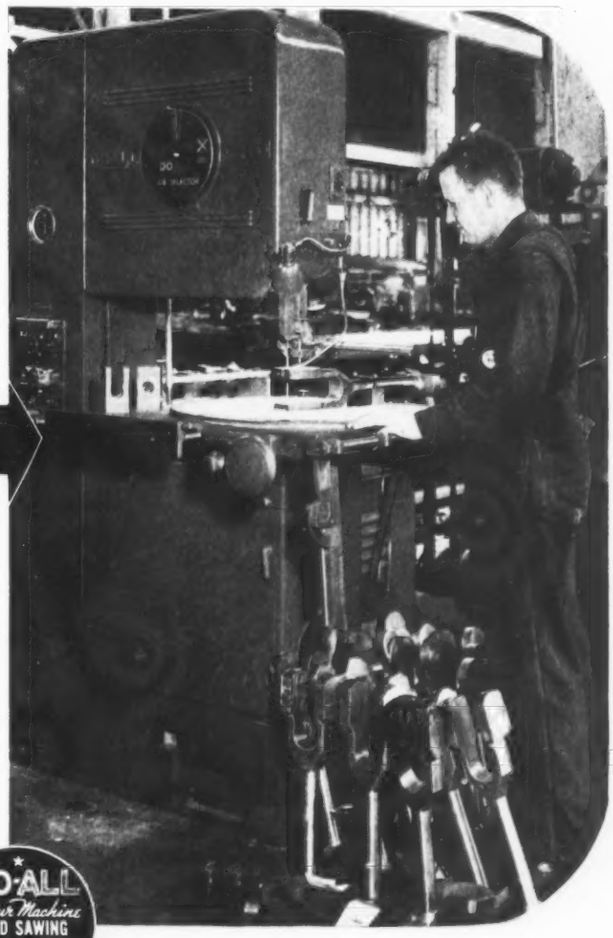
DoAll "SHORT CUT" Metal Worker

RUSH THAT JOB!

HOLDING UP PRODUCTION WAITING FOR IT!

EVERY DAY IS COSTING US MONEY!

—When customers write and wire like that, it's high time to get a DoAll, today's greatest time saver in metal working plants everywhere.



1/8 FORMER TIME—Connecting Rods for Diesel Engines made in less than 1 hour each at Sumner Iron Works, Everett, Wash. Former time—8 hours each.

★ ★ ★

1/3 FORMER TIME—Wrist Pins for Diesel Engines made from 45 carbon steel in 2 hours, 48 minutes each at Norberg Mfg. Co., Milwaukee, Wis. Former time—8 hours of milling.

PAYS ITS OWN WAY

This wonder worker in metal saves so much time, effort, temper and material that you can't afford to be without it—not if you use metal or alloys.

Takes the place of shaping, milling and lathe work on hundreds of jobs. Makes special parts, large or small, without dies. Cuts out 40 to 60 shapes at one time by stacking the sheets one above the other.

LET'S GET TOGETHER

We will send a factory trained man to your plant with a DoAll to show you what it can save for you. Just say the word.

FREE—*Literature and 158-page Handbook on Contour Machining.*

CONTINENTAL MACHINES, INC.

1312 S. Washington Ave., Minneapolis, Minn.

Associated with the DoAll Company, Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines.

and Carbon Corporation, president of the Union Carbide Co., and president of the companies in the electro-metallurgical group of the corporation. He has been connected with the corporation for more than twenty years.

FREDERICK E. MUNSCHAUER, vice-president and treasurer of the Niagara Machine & Tool Works, Buffalo, N. Y., has been elected president. He has been in the employ of the company for thirty-three years. GEORGE R. KINNEY,

Frederick E. Munschauer, New President of Niagara Machine and Tool Works

sales manager, who has been connected with the company for twenty-two years, becomes vice-president. GEORGE E. MUNSCHAUER has been made treasurer of the company, and ELMER D. HEINZ secretary.

George R. Kinney, Newly Elected Vice-president of the Niagara Machine & Tool Works

D. SAUNDERS' SONS, INC., 25 Atherton St., Yonkers, N. Y., manufacturers of pipe threading and cutting machinery, announce that they have leased their plant and business to the SAUNDERS MACHINE AND TOOL CORPORATION, of Yonkers, which will continue the manufacture of pipe threading and cutting machinery, and steam and gas fitters' tools, and, in addition, will build machine tools of various kinds.

B. E. MIDDLETON, formerly Chicago representative for the McKenna Metals Co., Latrobe, Pa., manufacturer of Kennametal steel-cutting carbide tools and blanks, has been appointed representative in the Central New York territory, with headquarters at 217 East Ave., Rochester, N. Y.

Ohio

H. L. KINNEY, who has been connected with the S. K. Wellman Co., Cleveland, Ohio, in various sales capacities since 1921, has been appointed manager of the machine tool division of that company. The company manufactures powdered metal friction products for use in aircraft brakes, tanks, automobiles, trucks, and machine tools.

L. W. WALLACE, research and management engineer, has joined the staff of the Trundle Engineering Co., Cleveland, Ohio, consulting engineers, as vice-president. Mr. Wallace was formerly director of engineering and research for the Crane Co. of Chicago.

DEAN R. WILSON has been appointed purchasing agent of the Warren, Ohio, plant of the Copperweld Steel Co., Glassport, Pa. He was previously president of the Anchor Drawn Steel Co.

Pennsylvania

MARSHALL E. MARCELLUS was recently presented with the first fifty-five-year service button ever awarded by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Marcellus joined the Westinghouse organization as a messenger boy at the age of twelve in 1886, the year the company was founded. He has seen the organization grow from a small factory employing 200 men to a company with more than 71,000 employes. He is at present connected with the coil insulation department, and will be eligible for retirement next month.

COOLIDGE SHERMAN has been appointed eastern sales manager of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Sherman has been associated with the company ever since his graduation from Yale University in 1916. Previous to his new appointment he was manager of valve steel sales.

D. W. R. MORGAN will direct over-all manufacturing operations in the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., as well as in the new $20,000,000 factory being built adjacent to the present plant.

RICHARD P. SWARTZ, vice-president of the Crown Can Co., Philadelphia, Pa., has been promoted to the special post of assistant to the president.

COMING EVENTS

OCTOBER 1-2—CONFERENCE ON PERSONNEL AND INDUSTRIAL RELATIONS OF THE AMERICAN MANAGEMENT ASSOCIATION at the Benjamin Franklin Hotel, Philadelphia, Pa. For further information, address American Management Association, 330 W. 42nd St., New York City.

OCTOBER 12-15—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Louisville, Ky. C. E. Davies, secretary, 29 W. 39th St., New York.

OCTOBER 16-18 — Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Royal York Hotel, Toronto, Canada. Ford R. Lamb, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

OCTOBER 20-22 — Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Edgewater Beach Hotel, Chicago, Ill. J. C. McQuiston, manager-secretary, 602 Shields Bldg., Wilkinsburg, Pa.

OCTOBER 20-24—Twenty-third NATIONAL METAL CONGRESS AND EXPOSITION to be held in Convention Hall and Commercial Museum, Philadelphia, Pa. Further information can be obtained from W. H. Eisenman, secretary, American Society for Metals, 7301 Euclid Ave., Cleveland.

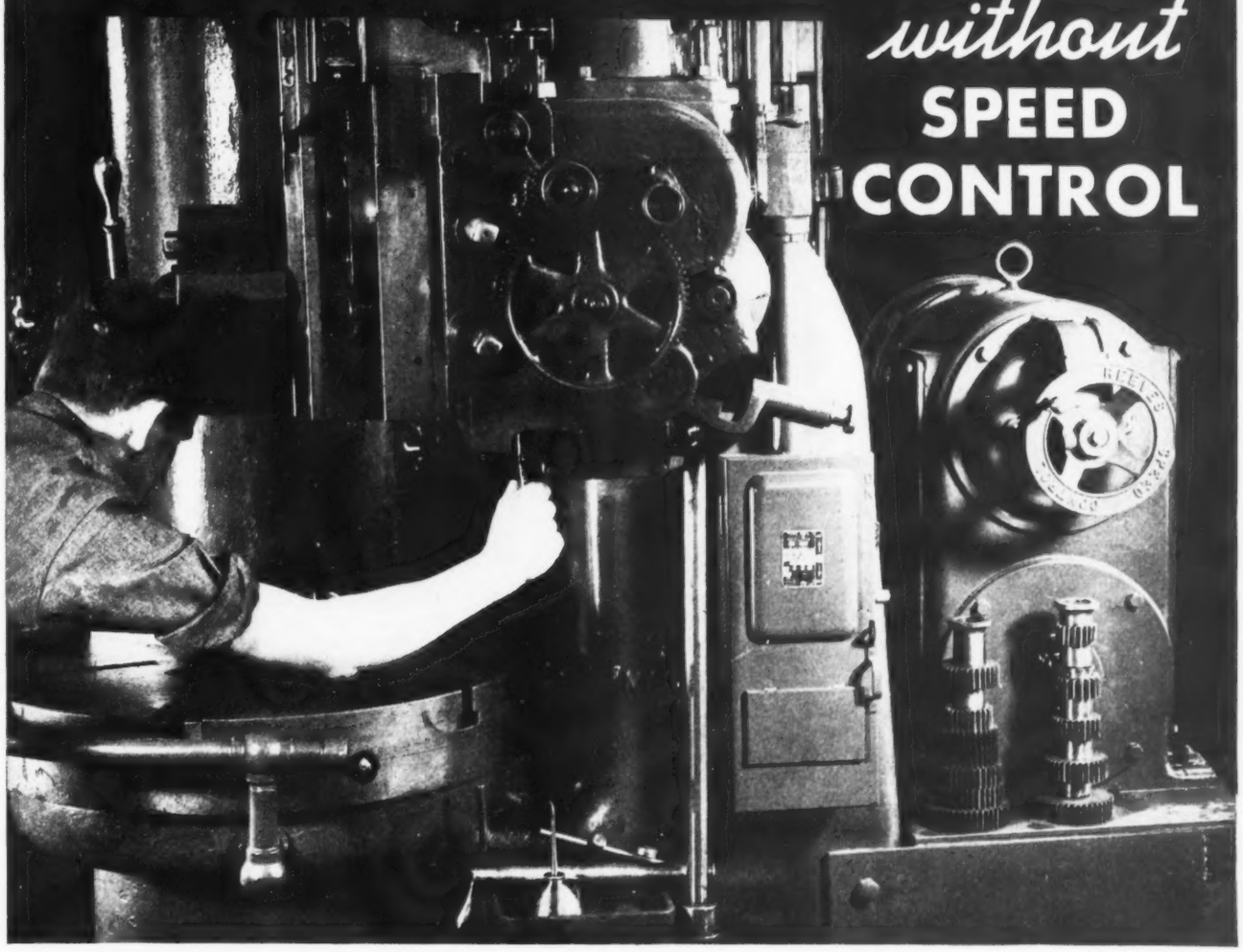
OCTOBER 22-23 — AMERICAN MANAGEMENT ASSOCIATION CONFERENCE ON OFFICE PROBLEMS IN A WAR ECONOMY at Hotel Pennsylvania, New York City. For further information, address the American Management Association, 330 W. 42nd St., New York City.

OCTOBER 30-NOVEMBER 1—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Astor, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 1-6 — EIGHTEENTH EXPOSITION OF THE CHEMICAL INDUSTRIES at

IMAGINE DEFENSE PRODUCTION *without* SPEED CONTROL



Never, in the same length of time, could American industry have turned out the thousands of machines of defense, now rolling off production lines, if we were still dependent upon antiquated lineshaft power transmission methods, step-cone pulleys and *fixed machine speeds.* Maximum *acceptable* production with fewest "rejects" comes only when machines are operated at exactly the right speeds—*not too fast, not too slow.*

But increased volume was not the only objective gained by the adoption of individual motorization of machine tools, and *infinitely variable speed control.* Higher quality of output, largely the result of accurate speed adjustability, has made American machines and manufactured products the envy of the entire world.

This company is proud of the part it has played in *pioneering, developing and perfecting variable speed control* units which are accepted throughout American industry as standards of comparison. Our plant is working at high pitch to meet the demands intensified by the present emergency for these units. If you have a machine, or a line of machines which make an essential contribution to our domestic or defense economy, and which can be made more productive with variable speed control, we will equip them for you.

REEVES PULLEY COMPANY, *Dept.* M, **COLUMBUS, INDIANA**

REEVES *Accurate Variable* SPEED CONTROL

Grand Central Palace, New York City. For further information, address Exposition of Chemical Industries, Grand Central Palace, New York City.

JANUARY 12-16, 1942—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 23-25, 1942—Spring meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Houston, Tex. C. E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 8-10, 1942 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Cleveland, Ohio. C. E. Davies, secretary, 29 W. 39th St., New York City.

NEW BOOKS AND PUBLICATIONS

AEROSPHERE 1941. Edited by Glenn D. Angle. 900 pages, 9 by 12 inches. Published by Aircraft Publications, 370 Lexington Ave., New York City. Price, $10.

This work is divided into four main sections, the first of which covers modern aircraft as built throughout the world, giving specifications relating to each type. The second section treats of aircraft engines, arranged, like the previous section, according to countries in which they are built. Then follows a voluminous compilation of aircraft statistics dealing with a great many phases of aircraft activities, military and naval uses, aircraft transportation, air mail service, etc. The fourth section contains a buyers' guide, listing names and addresses, with principal personnel and products made, of all firms engaged in every phase of aeronautics, not only in the United States but throughout the world. A special listing of manufacturers of all the products used in aeronautics is included. American manufacturers are listed geographically.

The section relating to planes has 553 photographs and sectional drawings of planes now being built by 265 manufacturers throughout the world. The engine section has 269 photographs and other illustrations of engines built by 118 manufacturers. The work is an unusually complete reference volume on aircraft manufacturing activities and on the statistics applying to the use and application of aircraft both for military and civil purposes.

METAL PROCESSING. By O. W. Boston. 630 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $5.

Professor Boston, chairman of the Department of Metal Processing at the University of Michigan and Professor of Metal Processing, has prepared this work as a college textbook, but it is adaptable also for use in short industrial courses. As it covers extensively typical machining operations and has comprehensive recommendations for practical applications, it should be of use to production, tool, and designing engineers, superintendents, foremen, and draftsmen.

A revision of the two former volumes of "Engineering Shop Practice" and a consolidation of these with more recent data have led to the present volume, which is the result of twenty years' experience in teaching the subject of machine shop practice to upper classmen of the mechanical and aeronautical engineering departments at the University of Michigan. The book emphasizes particularly the nomenclature of tools and the subject of machinability. Extensive data is given to show cutting forces, power, tool life, chip formation, and surface quality, as influenced by the properties of the material being machined, the cutting fluid, and the tool shape and quality.

MECHANICAL ENGINEERS' HANDBOOK (Fourth Edition). Edited by Lionel S. Marks. 2274 pages, 4 3/4 by 7 inches. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $7.

This is the fourth edition of a well-known handbook for the mechanical engineer. In the eleven years since the previous edition was published, great advances have occurred in practice, theory, and in the systematization of knowledge in the mechanical engineering field. In addition, there has been considerable activity in standardizing machine elements, materials, and processes. The object of the present edition of this book is to include the more important parts of this new material.

Among the new subjects are the theory of models; plastic behavior of materials; stress concentration; creep; packings; wind pressure on structures; sound and noise; automatic control of processes; and powder metallurgy. Most of the sections have been completely rewritten in order to incorporate the new material, and the original material has been condensed whenever possible so that the book will not be too bulky. The data presented in the book has been contributed by a large number of engineers and scientists.

THE DESIGN OF MANUFACTURING ENTERPRISES—A Study in Applied Industrial Economics. By Walter Rautenstrauch. 298 pages, 6 by 9 inches; numerous illustrations and charts. Published by the Pitman Publishing Corporation, New York City. Price, $3.50.

The general purpose of this book is to guide the engineer and students of engineering through the usual problems of economic calculation encountered during the growth and development of a business. The book endeavors to bring together in a single volume the essential principles and methods of cost calculations used in designing and redesigning manufacturing enterprises. It is suggested that the engineer or student using this book should study the author's book, "The Economics of Business Enterprise" as a preliminary text covering the same subject matter. The present book is divided into two parts; the first deals with the business as a whole, and the second with selected problems.

IMPACT RESISTANCE AND TENSILE PROPERTIES OF METALS AT SUBATMOSPHERIC TEMPERATURES. By H. W. Gillett. 112 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, $2.50.

DIAMOND CORE DRILL FITTINGS (Third Edition). 21 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Commercial Standard CS17-42 of the National Bureau of Standards. Price, 10 cents.

PRINCIPLES AND PRACTICE OF HEAT-TREATMENT. By J. Winning. 99 pages, 5 by 7¼ inches. Published by Emmott & Co., Ltd., 31 King St. W., Manchester 3, England. Price, 2 shillings, net.

DISPLACEMENT, VELOCITY, AND ACCELERATION FACTORS FOR RECIPROCATING MOTION. By Levi B. Smith. 17 pages, 6 by 9 inches. Published by the author, P. O. Box 317, Hampton, Va. Price, 40 cents.

* * *

Lincoln Reports Price Reduction

Two years ago, the Lincoln Electric Co., Cleveland, Ohio, publicly pledged itself not to increase its selling prices. It is now renewing the pledge, and points out that during the last two years the company has not only followed the policy of maintaining prices, but has actually reduced the selling prices on arc-welding machines and electrodes by more than 6 per cent. This was made possible, it is stated, by increased manufacturing efficiency, resulting from the cooperative spirit and ability of the employes, in spite of rising labor and material costs.

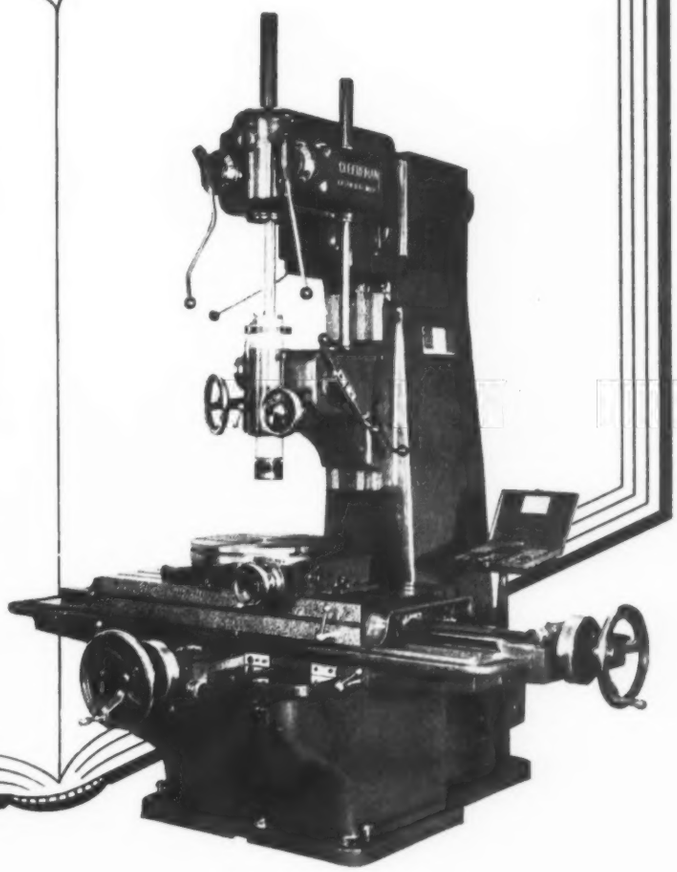
Critical Days...

"CRITICAL" *machines!*

Cleereman Jig Borers are officially designated as "critical" machines—they are vital to America's Defense Program.

This is an old experience for *Cleereman* Jig Borers, because they already have successfully met all the exacting requirements of normal peace times.

Cleereman Machines will still be vitally essential to America's great metal working industry long after the strain of rearmament is past.



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Sales Division of
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CLEEREMAN

DRILLING MACHINES and JIG BORERS

OBITUARIES

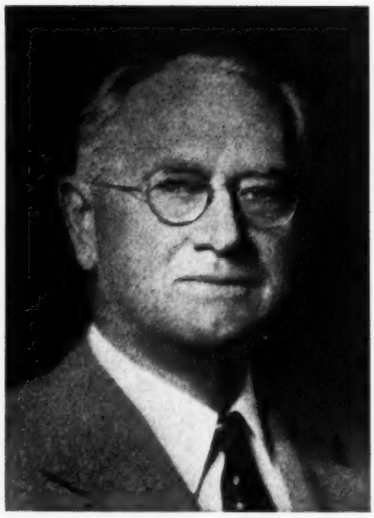
Alvan T. Simonds

Alvan T. Simonds, president of the Simonds Saw & Steel Co., Fitchburg, Mass., died on September 2 at the age of sixty-four years. Mr. Simonds was born in Fitchburg. He graduated from Harvard University in 1899, and studied metallurgy in Sheffield, England. Upon completion of his studies, he entered the service of a steel mill operated by what was then known as the Simonds Mfg. Co. He first worked as a chemist and later filled many positions, including those of foreman of the knife department, entry clerk, cost department clerk, steel mill manager, and vice-president. He became president of the Simonds Saw & Steel Co. in 1913. Later his brother, Gifford, filled this office for some years; but it was resumed by Mr. Simonds at the time of his brother's recent death.

Alvan T. Simonds

Walter D. Sayle

Walter D. Sayle, president of the Cleveland Punch & Shear Works Co., Cleveland, Ohio, died on September 5, in his eighty-first year. He was active in business until about a month before his death, when he suffered a heart attack. Mr. Sayle was born in Cleveland in 1861, and was educated in the public schools of that city, graduating from the Central High School in 1880, the second year after it was opened. In 1886, he helped to establish the East End Savings Bank Co., and became head of a branch of the bank which was established the following year. In 1890, he founded the Cleveland Punch & Shear Works Co., and in 1903 purchased the City Foundry Co. which furnished the former company with its iron castings. In 1897, Mr. Sayle organized the Cleveland Crane & Engineering Co. and began the manufacture of electric traveling cranes, an industry which was then in its infancy. He purchased a controlling interest in the Ohio Machine Tool Co. in 1911. Mr. Sayle was president of all these concerns at the time of his death. He was also a member of the National Metal Trades Association, and served one term as its president in 1906. He was on the Administrative Council of the Association for several terms.



Walter D. Sayle

HAROLD J. STEIN, director of research, chemistry, and metallurgy with the Allis-Chalmers Mfg. Co., Milwaukee, Wis., died on September 9 at the age of forty-seven. Mr. Stein had been directing the activities mentioned since 1939, when they were consolidated into one department. He became connected with Allis-Chalmers as a student apprentice in 1916, and served in various manufacturing departments upon completing his apprentice course. He was, in turn, general foreman of the company's heat-treating operations, assistant foreman of the forge department and research engineer. In 1936, he was made chief research engineer of all the manufacturing departments.

He was born in Philadelphia, Pa., and attended the Tri-State College at Angola, Ind. For many years he had been a member of the American Society of Testing Materials, the American Foundrymen's Association, and the American Society for Metals, the Milwaukee chapter of which he was instrumental in founding.

ROBERT V. GOOD, manager of the Philadelphia Works of the General Electric Co. since 1936, died September 17, at his home in Drexel Hill, Pa., following a long illness. He was fifty years old. Mr. Good was born in Germany on December 9, 1890. He attended the Royal Technical School at Stuttgart and was graduated in 1911. In that year he came to the United States, obtaining employment in Cincinnati. In 1913 he joined the General Electric Co. in the general superintendent's office at Schenectady. In 1923, he was made assistant to the superintendent of the induction motor department. On January 1, 1928, he became superintendent of the milling department, one of the largest divisions of the G-E Schenectady Works. In May, 1929, Mr. Good was transferred to the Philadelphia Works as assistant manager, and was appointed manager in February, 1936.

JOHN MORSE, son of Colonel Robert H. Morse, president of Fairbanks, Morse & Co., Chicago, Ill., was killed in an automobile accident on August 22 when the car in which he was riding collided with a bus in a dense fog on the approach to the Golden Gate Bridge at San Francisco, Calif. Mr. Morse was twenty-five years of age, and graduated from Yale University in 1937. Since last April, when he resigned from the United States Navy because of an eye deficiency, he had been assistant manager of Fairbanks, Morse & Co.'s San Francisco branch.

HUGH A. SCALLEN, district manager for the New England branch and warehouse of the Jessop Steel Co., with offices at Hartford, Conn., died suddenly of a heart attack on September 2 while driving his automobile. Mr. Scallen was forty-six years old. He had been affiliated with the tool steel industry for twenty-three years, and was a member of the American Society for Metals.

* * *

One-Hundredth Anniversary of John A. Roebling's Sons Co.

The John A. Roebling's Sons Co., Trenton, N. J., famed builder of the Brooklyn Bridge and supplier of the steel cables that support such recent structures as the George Washington Bridge in New York City and the Golden Gate Bridge in San Francisco, celebrated its one-hundredth anniversary on September 19. After a luncheon had been tendered to a group of editors and publishers, the guests were taken on a tour of the three Roebling plants, where they had the opportunity of seeing some of the National Defense activities of the concern. A dramatic sequel to this tour was the testing of a 4-inch cable to the breaking point under a machine that can apply a breaking load up to two million pounds. In the evening a dinner was given at the Nassau Tavern, Princeton, N. J., at which the speaker was Leon Henderson, Price Administrator and Director of OPM's Division of Civilian Supply.